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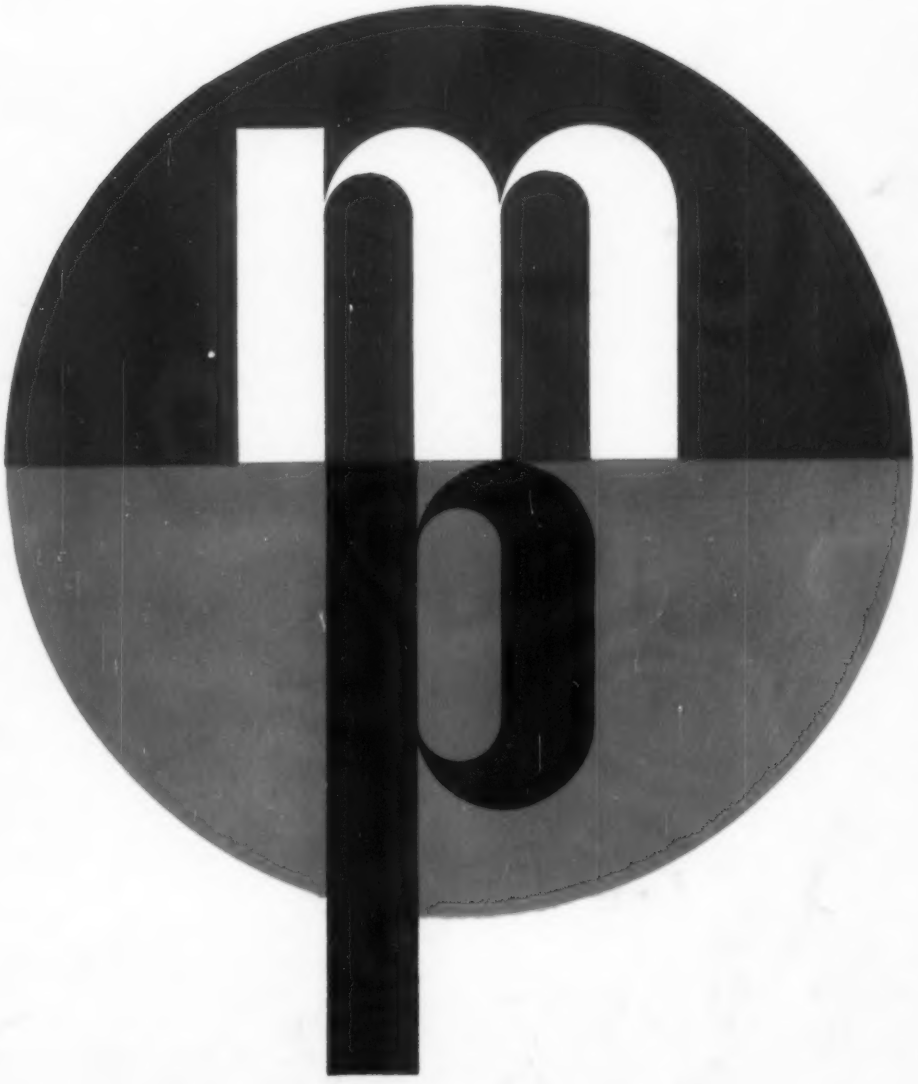

July 1956

page 35 **The Plastiscope, Section 1 . . . fast reading news of the industry**

page 97 **Report on the National Plastics Exposition and S.P.I. Conference**

How DUREZ RESINS help you get better rubber stocks

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MODERN PLASTICS*

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Number 11

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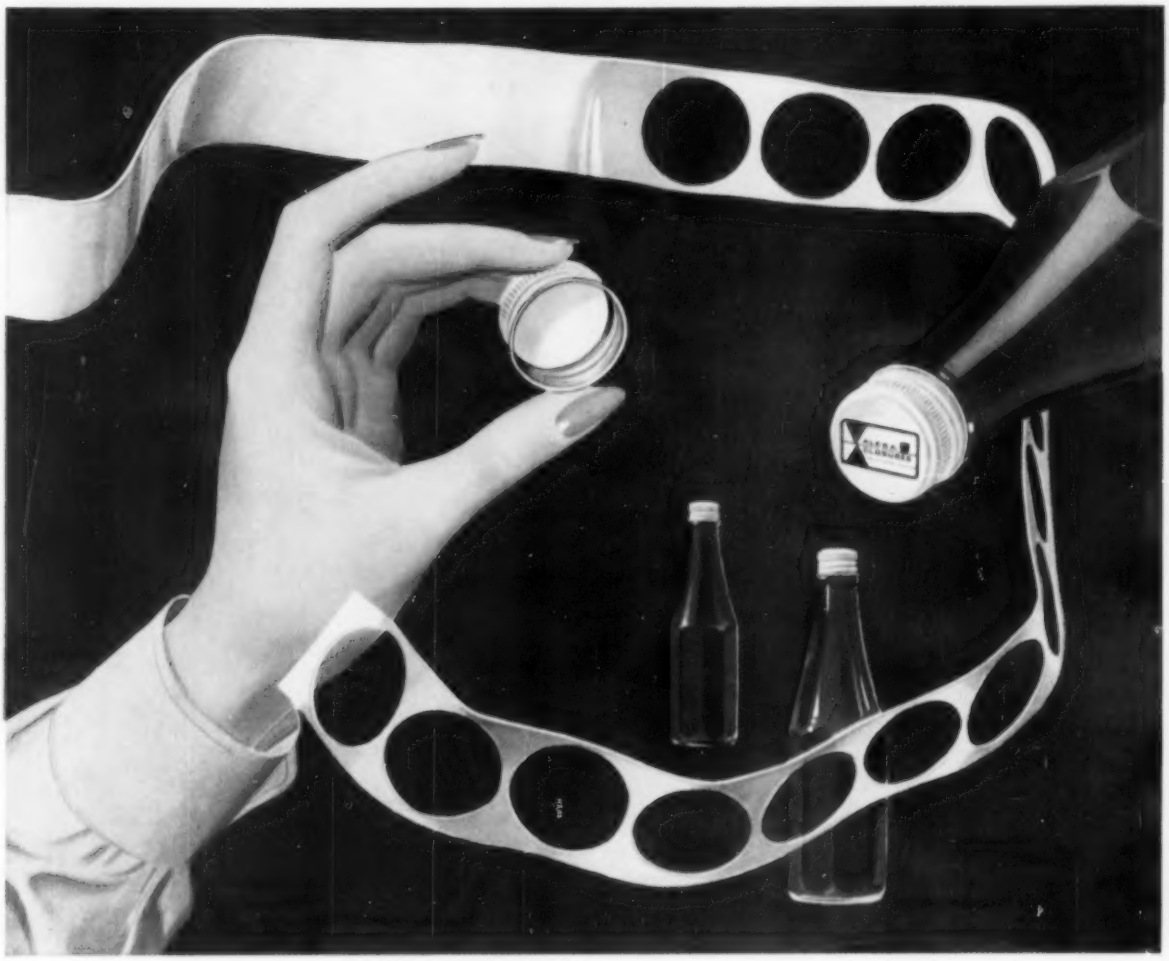

Geon liner provides a new twist in bottle closures

SO popular is Alcoa's new HyTop closure that nearly all major brands of catsup today wear this new cap.

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phenolic parts by Chicago Molded

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For the impeller, they came up with a cotton-filled phenolic material that's strong enough to take the whirling beating of high speed, yet is resistant both to moisture and to household detergents. The steel shaft of the impeller is inserted during molding – incidentally, positioning of this shaft demands extreme accuracy.

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Editorial

Modern obsolescence

Plastics processors, whether custom, proprietary, or captive, who attended the 7th National Plastics Exposition had one comment in common to make: "Our plants get obsolete at a faster pace today!" The trend toward automation was obvious in every booth which featured equipment. Platform discussions at the S.P.I. Annual Conference also emphasized this trend as well as the trend toward better controls.

Webster's Dictionary defines an obsolete machine or method as one which is worn out, no longer in use, or out of date. As far as plastics processing equipment is concerned, we suggest that obsolescence today means simply that something better, faster, and more efficient is available. In the light of this suggested new definition and in the face of up-coming competition, not a few injection machines installed only five years ago are quite obsolete today. The same thing goes for compression presses, vacuum forming equipment, and extruders. One process engineer with 30 years' experience opined that there was more progress in equipment design for plastics processing in the past two years than in the previous ten.

With the availability of a broad range of plastics materials having specific properties, with new markets for plastics components growing constantly larger but becoming at the same time more specialized from the standpoints of engineering and design, the problem of obsolescence in molding plant equipment according to the new definition is growing and will continue to grow more serious every day.

Involved are several factors: a) selection of new equipment with a view to coordinating it with present plant; b) selection of new equipment with a view to future needs; c) modernization of old equipment to bring it in line with the latest developments; d) training of staff accustomed to old equipment to operate the latest, and to maintain it; d) sounder financing for both up-grading of old equipment and purchase of new; f) establishment of accelerated write-off policies; g) decision to completely discard certain equipment which may or may not yet have been written off.

The modern meaning of the word obsolescence in relation to plastics processing equipment puts a new and continuing burden of decision on all plastics processors.

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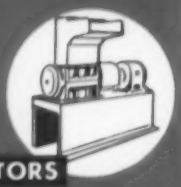

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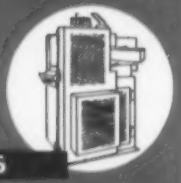

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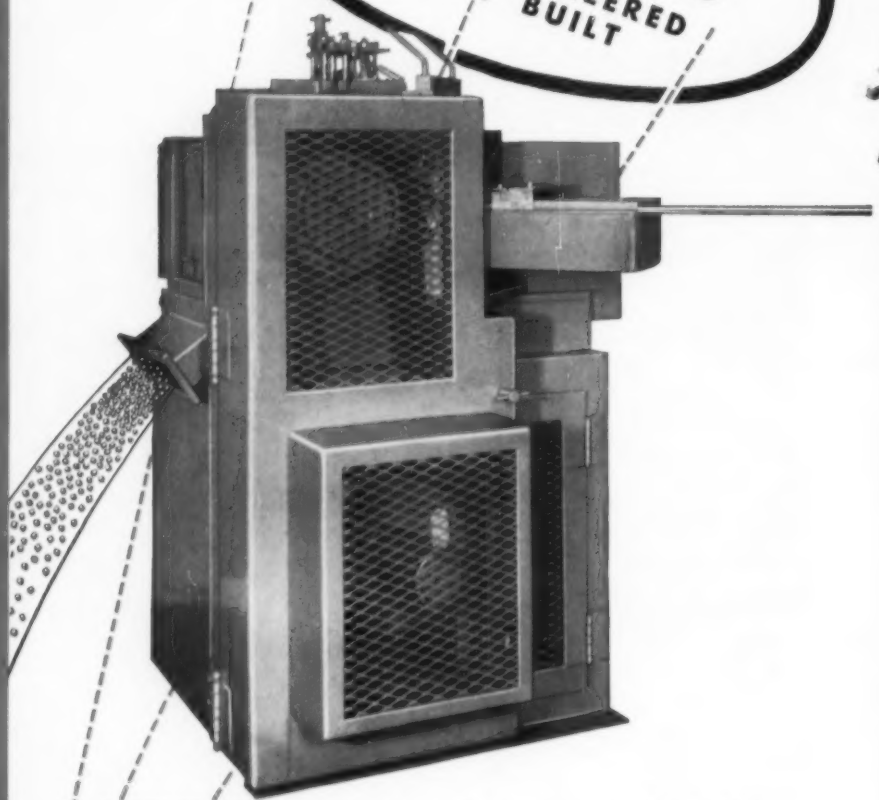

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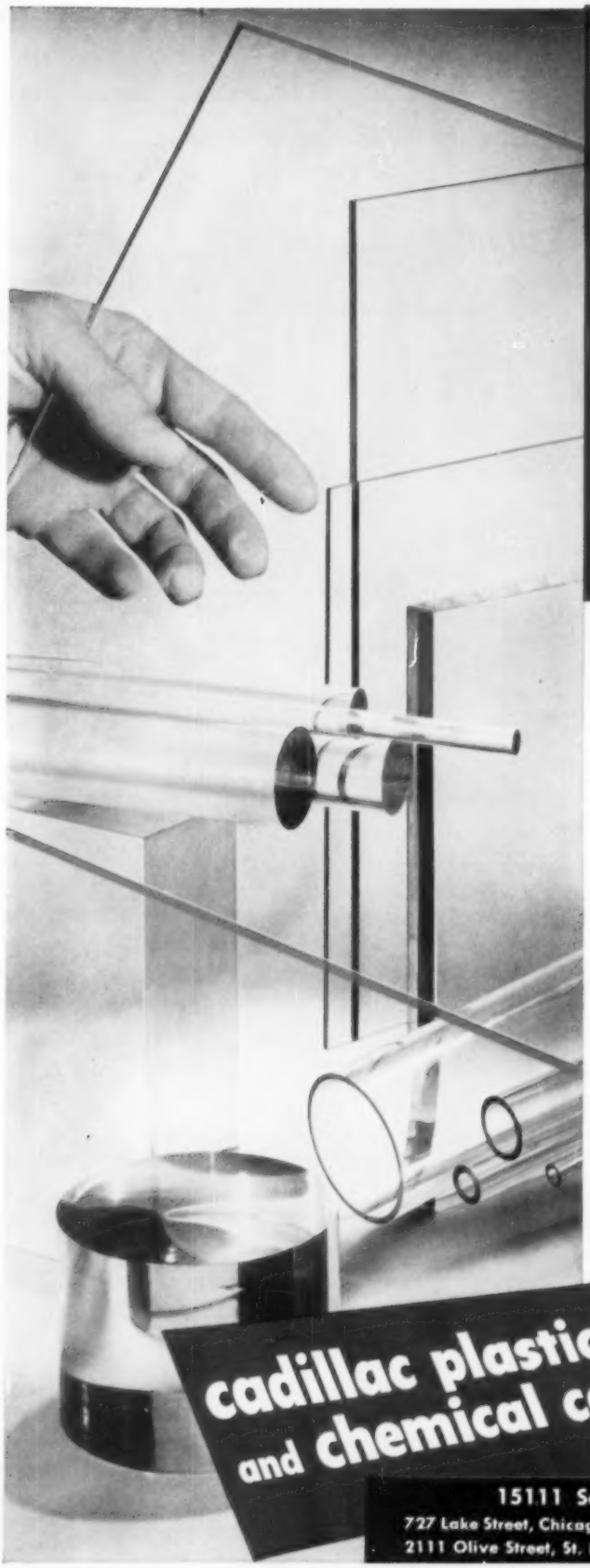

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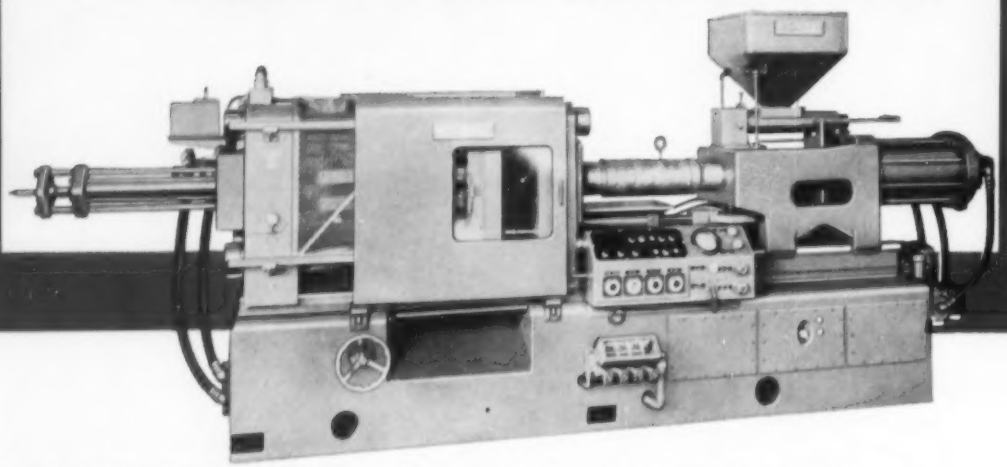

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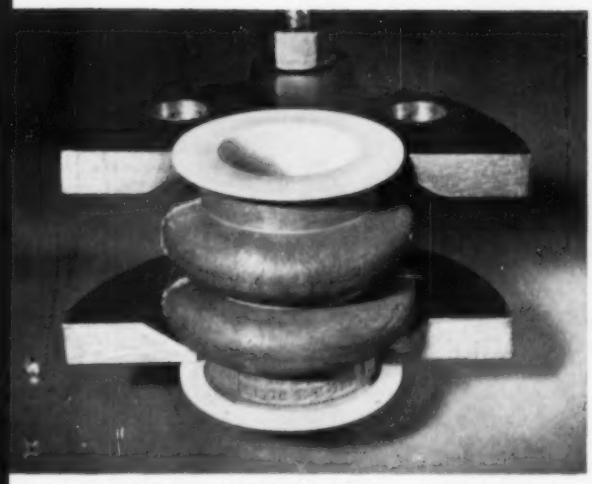

TEFLON® is used as a lining for expansion joints, such as this, designed for use in the chemical industry at elevated temperatures and pressures.

ALATHON® provides dripless sleeves for chemical bottles. Sleeves of ALATHON polyethylene resin increase handling safety by eliminating drip during pouring.

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neck of the bottle, eliminates drip during pouring, increasing handling safety in the laboratory. The properties of ALATHON make it a superior packaging material for many uses. It is used in the form of film, bottles and other containers, closures, liners for metal and fiber drums and multi-wall bags. The chemical and physical properties of ALATHON remain unchanged with age. (Sleeve molded by the A. L. Hyde Company, Grenloch, New Jersey.)

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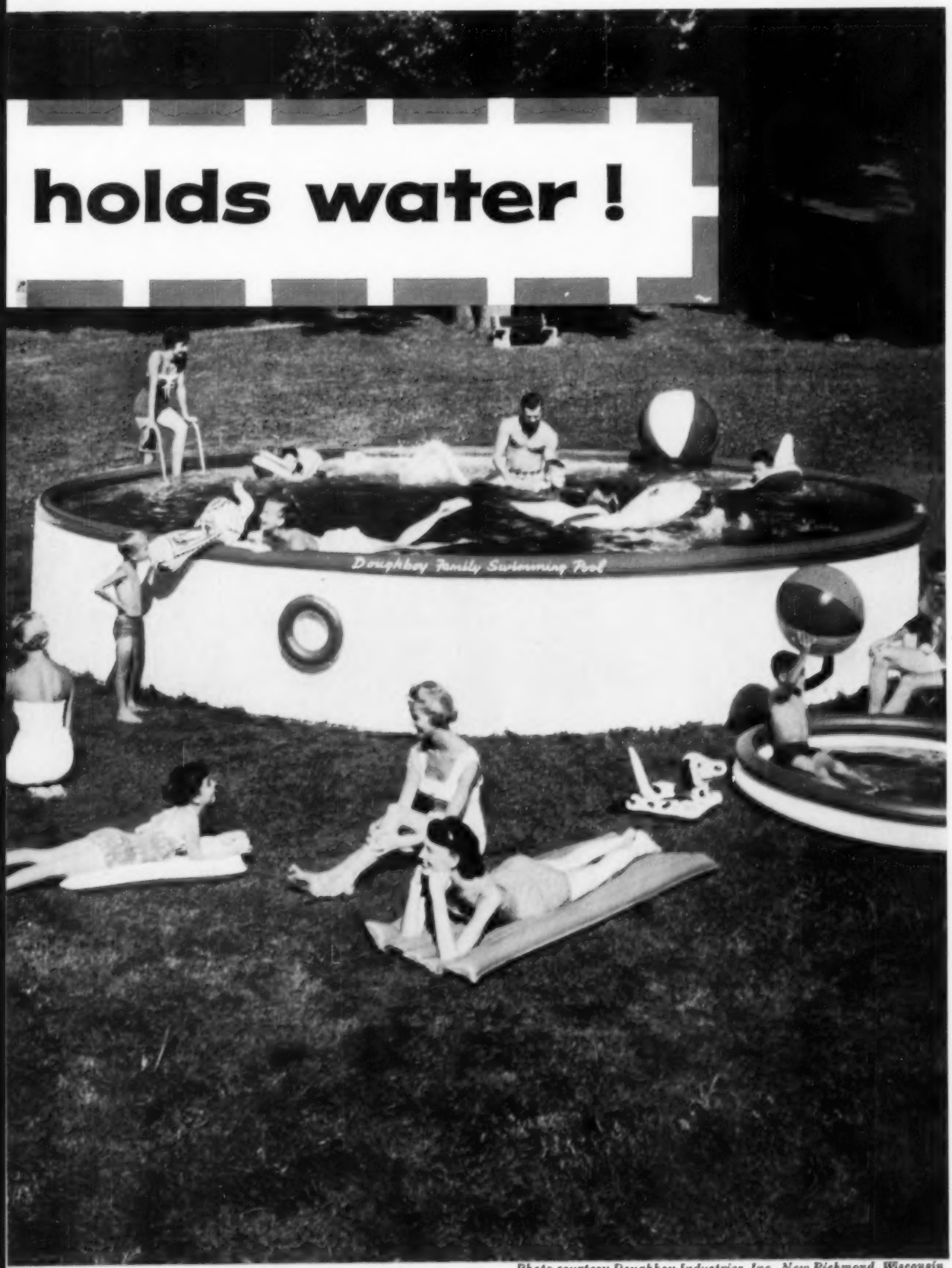

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Our output is wholly-integrated back to basic raw materials within the Allied Chemical group. Our production is efficient, continuous, completely competitive in every respect. We welcome inquiries from present and prospective makers of adipates, adipic polyesters and polyurethans.

SEND FOR TECHNICAL BULLETIN I-12

This comprehensive 8-page technical bulletin on National Adipic Acid gives physical and chemical properties; principal reactions of the carboxyl and alpha methylene groups; solubility curve, and suggested uses with copious literature references.

Allied Chemical

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

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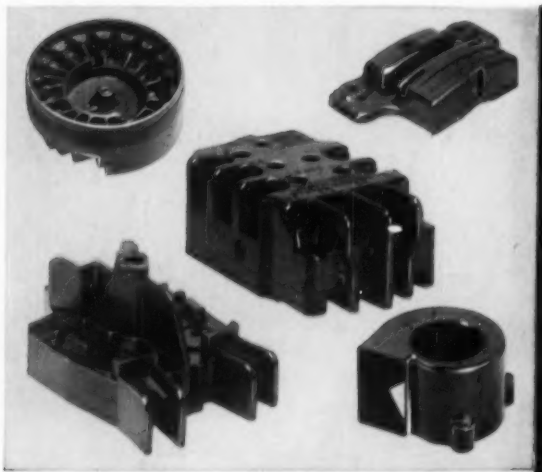

in plastics too . . . most engineers *think ahead* with a "K". *(Kurz-Kasch . . . that is!)*

All signs point to . . . MEN . . . who help you solve your plastic problems.

Kurz-Kasch can't build a *Broadway Spectacular,* but, no one knows more about the moulding of standard thermosetting plastics or the new Teflon or glass-filled polyesters—than our thinkers. *(Thinkers—that is!)*

Compression, transfer and plunger moulding are as easy as printing the words: *"Tables for Ladies"* over a swinging door.

We follow your specifications to the letter.

And speaking of signs . . . *here they have one that says "THINK OR THWIM" . . . we prefer to think!*

Why not *sign up* now?

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Help! Send your representative to our rescue. We have a thermosetting plastic problem.

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SPECIALISTS IN THERMO-SETTING PLASTICS FOR 40 YEARS.

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IS IT A CLEAN POWDER?

DOES IT MOLD WELL?

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CAN I GET A QUICK ANSWER TO A SPECIAL PROBLEM?

WHEN YOU MOLD WITH **FOSTARENE,** YOU MOLD WITH ONE OF THE MOST SATISFYING POLYSTYRENES EVER FORMULATED!

Fostarene is tested as no other polystyrene can be . . . in its makers own molding operations. Fostarene means *service* . . . personal, interested service from top executives and the most experienced polystyrene molding specialists. You can depend on Fostarene.

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GENERAL-PURPOSE • HIGH IMPACT • HIGH FLOW • **A VIRGIN POLYSTYRENE**

Available in pellets, granules and fine grind for dry coloring . . . in crystal clear and a full range of custom colors.

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BOOST PRODUCTION!

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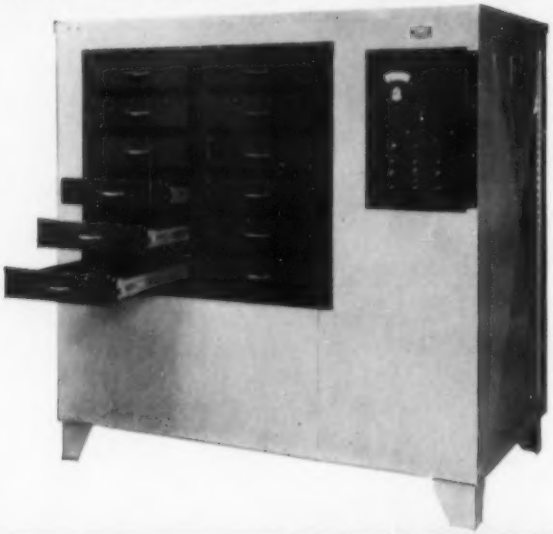

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Sealing Drawers! ½ HP Fan! 10 KW Heat for Quick Recovery: The Only Oven Built Expressly for All Thermoplastic Work. Price Complete for 220-volt Operation $1638.50

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5 Gal. $210.60
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Bottom Drain—Side Heat Only —Based on Dupont Suggestions for Safe Use of Hitec Salt or Wax

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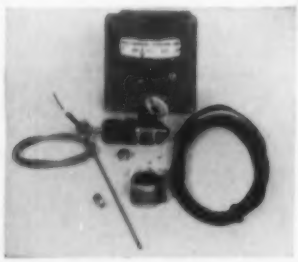
WITH NOZZLES BASED ON DUPONT SUGGESTIONS

MODEL A— with Variac Control

Price, complete with 1¾"—8 thread, 5" nozzle, 3/16" orifice, ½" or ¾" radius nozzle $176.00



MODEL C— with Pyrometer

Price complete as shown with 1¾"—8 thread nozzle 3/16" orifice, ½" or ¾" radius $410.50

Write for prices on other nozzle types.

Send for our 1956 Nozzle Catalog today. You'll find all styles of nylon nozzles described and priced on pages 32-35—with technical notes on nylon molding. Prompt service on all kinds of nozzles by the world's largest and most experienced nozzle specialists.

INJECTION MOLDERS SUPPLY CO.

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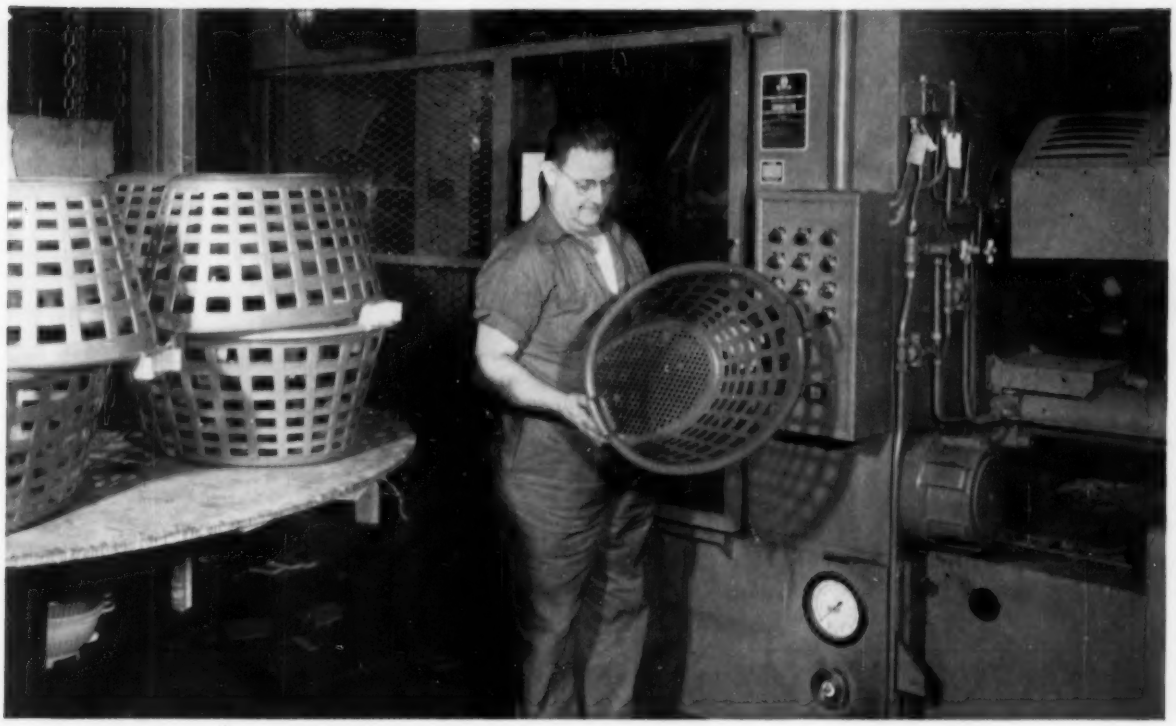
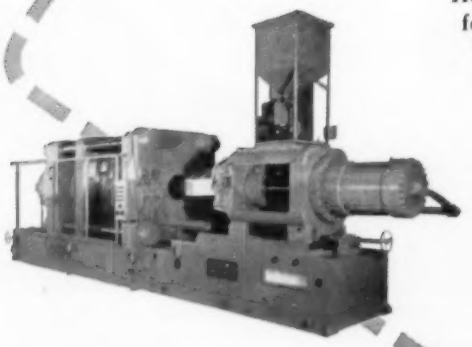
BASKET WEAVER—1956!



H-P-M 80 oz. molds Big Basket for the Monday morning market



Bring your production up to date with an H-P-M injection molder. 6 to 400 oz. capacities . . . 150 to 3000 tons clamping force.

Here's a real producer at work—every weekday!—for Columbus Plastic Products, Columbus, Ohio. This 80 oz. H-P-M Injection Molding Machine turns out polyethylene clothes baskets by the dozens every hour. An exceptional production rate is only one of H-P-M's big advantages. Here's where big molding areas and plenty of plasticizing capacity pay off. These big baskets are "shot" with a high-speed injection plunger that assures instant fill in complex molds. Get in the market—to stay—profitably—with H-P-M injection molding machines. H-P-M Bulletin 5601 tells you how.

HPM

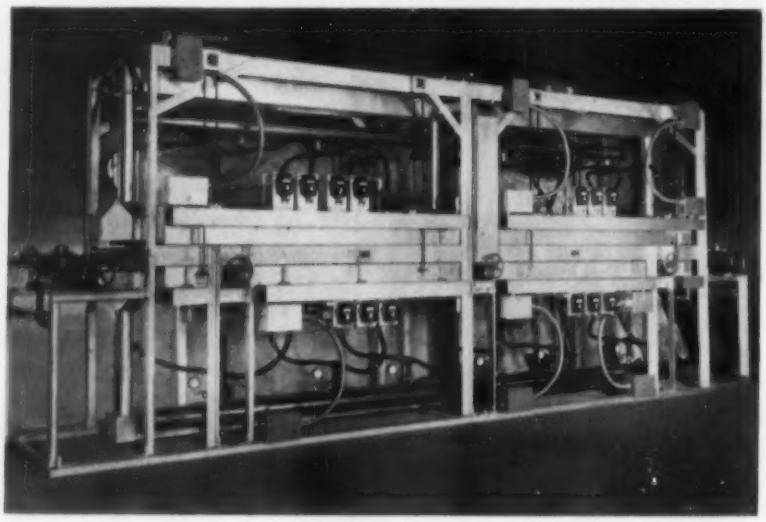
PLASTIC DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

It's hot! Combination VAPO FUSER and Tenter Frame

heat treats and fuses single or double coated web—to a definite width

Temperatures up to 950° F.

Unit shown in operating position. Heater sections retract when web is stopped.



Temperature Range—200°F to 950°F

Electric Heater Capacity — 195 k.w.

Length — 22 ft.

Width — 5 ft.

Height — 12 ft.

Units can be built in any size, to meet customer's requirements.

Can be furnished without tenter frame if desired.

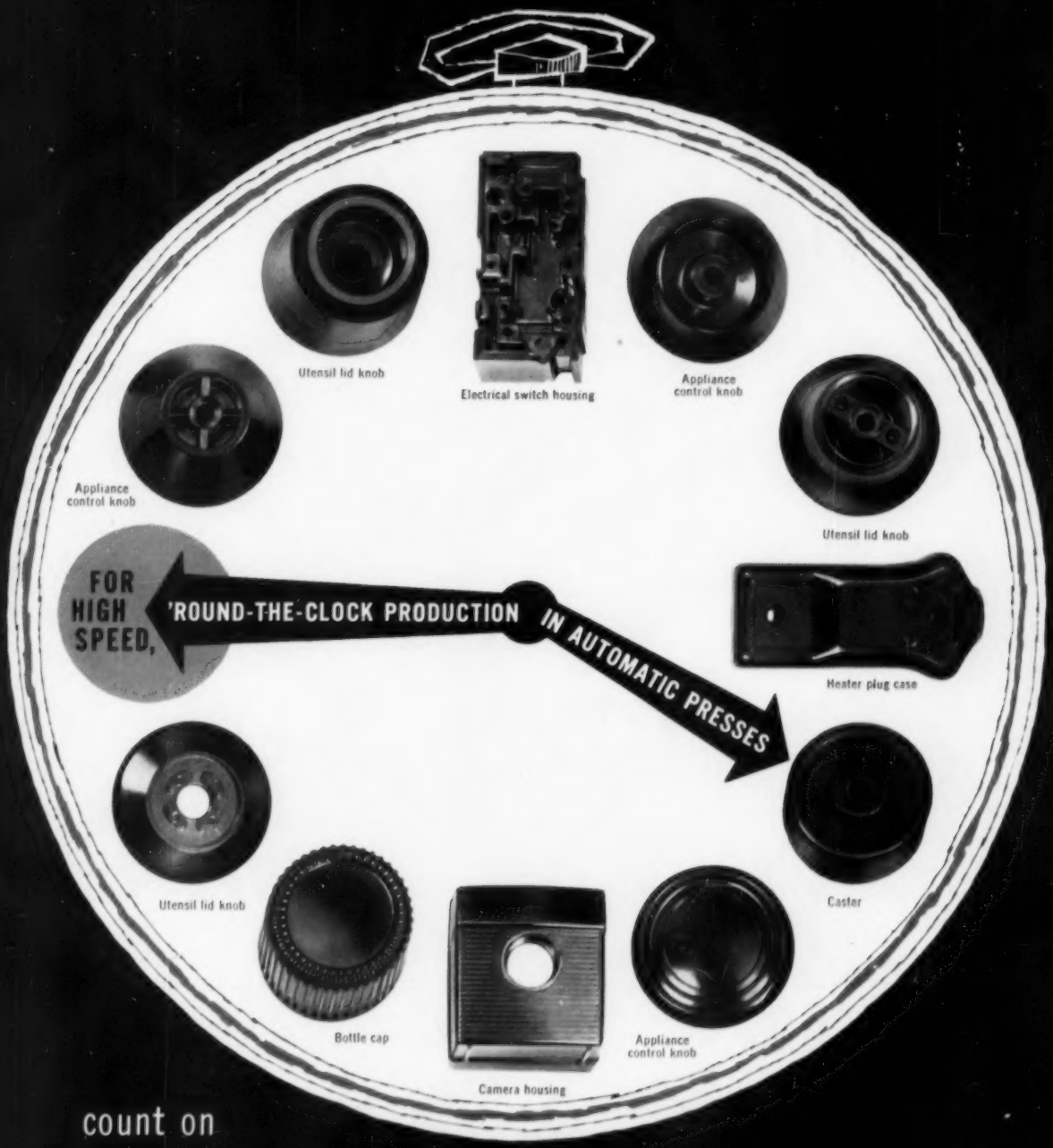
The Dawson Vapo Fuser provides accurately controlled heat that will efficiently handle your most critical jobs. You can cure rubber, and fuse vinyl or other thermoplastic coatings—up to 20 ounces of coating per square yard of bare stock—to any web material. You can cure phenolic resins and extract solvents from coating formulations, too.

Even tension is maintained throughout drying and curing. Result—a perfectly flat, wrinkle-free finish. Special clips hold the web to a predetermined width.

Write for your free copy of the Dawson catalog of curing, drying and fusing equipment.

F. C. DAWSON ENGINEERING COMPANY

Canton, Massachusetts



count on

Plenco 456 and 386 Black Phenolic Molding Compounds

More and more molders of gleaming appliance knobs, electrical outlet plates, terminal blocks, switch parts, camera housings, casters and other such items specify Plenco 456 Black for best results in automatic presses. This general purpose phenolic molding compound has low gas evolution and minimum "case hardening." Fast cycles can be obtained even on very thick sections. Readily accepts electronic preheating.

Plenco 386 Black—similar in formulation—is used in automatic press molding of products where non-bleeding characteristics are important.

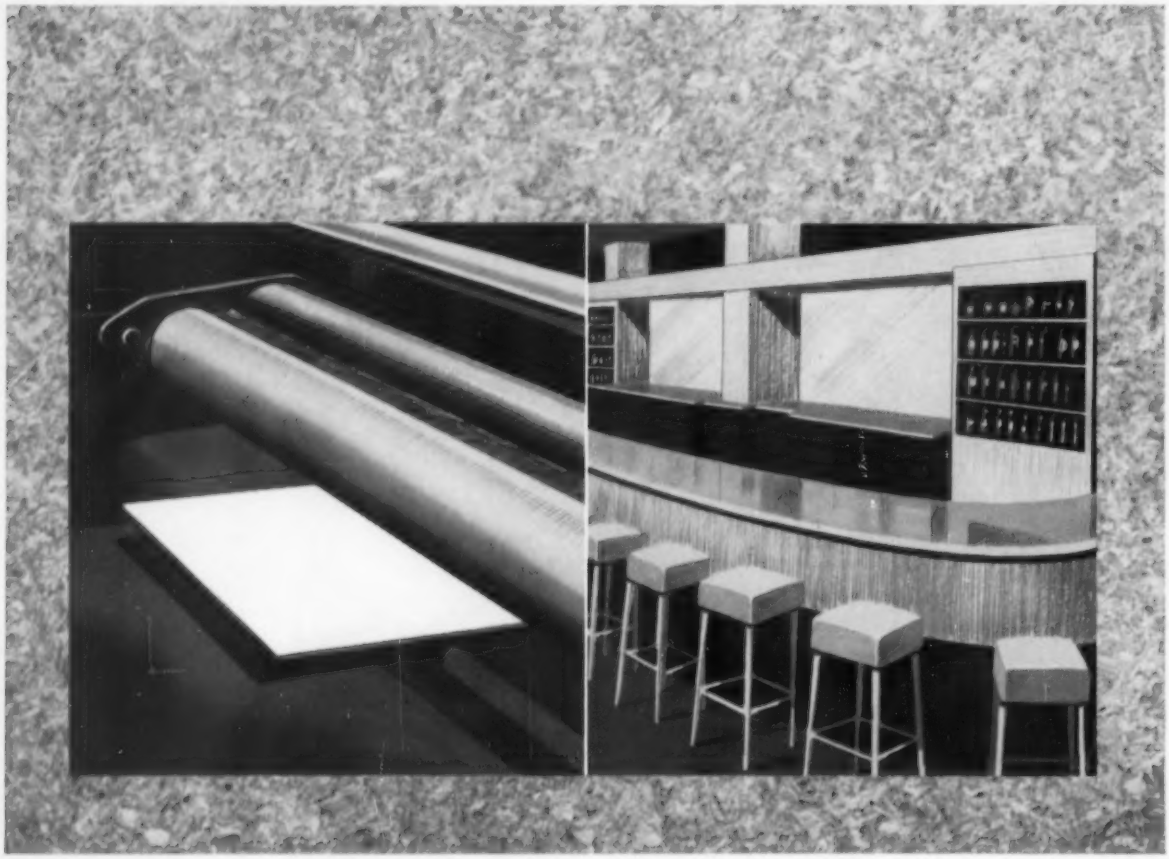
These are but two of the many top quality phenolic materials developed by our engineers for specialized use in industry. We invite you to consult with us about *your* specific molding problems; it is very likely we already have the answer for you.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

AN IDEAL BASE FOR BETTER PRODUCTS



WEYERHAEUSER 4-SQUARE PARTICLE BOARD—
Helps Insure Basically Better Products

FOR BASIC SOUNDNESS and quality in laminated and veneered products, it's the core that counts. A base that is flat, smooth, uniformly dense and dimensionally stable eliminates costly processing steps, helps provide finer appearance, better performance in the finished product.

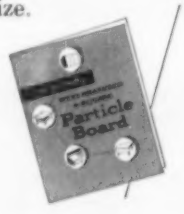
Weyerhaeuser 4-Square Particle Board has been especially engineered by Weyerhaeuser to meet these specific needs. Because of its flatness, stability and uniformly sanded surfaces, it makes an ideal base for wood veneers, decorative plastics, metals or other decorative surfaces.

Panels can be worked with the same machines and tools as wood, cut readily with high speed equipment. Edges can be treated with special putties or edge-banded with wood, plastic or metal moldings.

4-Square Particle Board is highly recommended as a core material for dinette table, sink, counter and bar tops, for case goods, furniture parts, cabinet and sliding doors, displays . . . any product that requires a stable, easily worked panel material. Thicknesses from $\frac{3}{8}$" to 1" . . . panels are 4' x 8' or cut to your size.

WRITE FOR BOOKLET

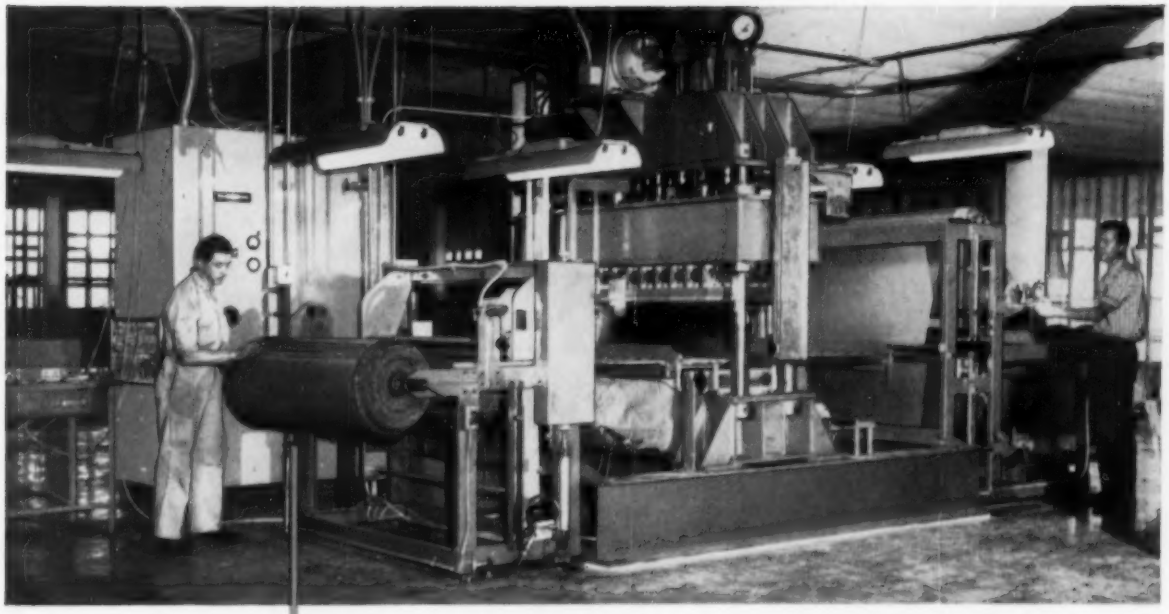
Check the physical properties of this new and outstanding core material. Read more about the features and advantages that can mean profit for you. Write today.



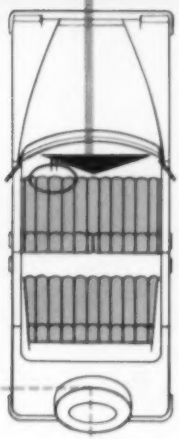
Weyerhaeuser Sales Company

DEPARTMENT PJ-76

First National Bank Building • St. Paul 1, Minnesota



At the Masland Duraleather plant in Philadelphia, sheets of Masland Duran vinyl plastic are electronically welded to a backing, producing a handsome quilted upholstery fabric for automobiles and other uses. The work is done by a large, completely automated Thermatron press in conjunction with a Thermatron generator and indexer. Full rolls of plastic are fed into the press, quilted and rewound in one continuous operation with only supervisory operators.



America's newest cars owe so much to plastics welded by

Thermatron®

HIGH FREQUENCY SEALING AND HEATING EQUIPMENT

Electronically welded plastic products for the automotive industry include . . .

- Door panels
- Upholstered seats
- Safety cushioning
- Convertible tops
- Reservoir bags for windshield wipers
- Interior head linings
- Visor pouches
- Tool kits
- Carburetor filters

You've admired that attractive upholstery in many new cars. It's vinyl plastic, weld-quilted by Thermatron equipment. Then there's the safety cushioning of the sun visors and dashboards. Thermatron does that too — welds and shapes the foam filled visor for more shock resistance.

Because of Thermatron, plastics have become an important part of modern automobile design, and the applications are unlimited. If *you* have a new plastic product in mind, our engineers will be glad to run tests on your own material and make suggestions. Write today to Dept. 106.

Radio and Electronic Products Since 1922

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FACTORIES IN BROOKLYN, N. Y.

E. F. DECOR

Division of Einson-Freeman Co., Inc.

EXCLUSIVE
LICENSEE
UNDER U. S. PATENT
NO. 2,646,380

FOR SPECIAL PROCESS TO DECORATE PLASTIC DINNERWARE

E. F. Decor Division of Einson-Freeman Co., Inc. announces with great pride it is in a position to work with molders in the U. S. and Canada on a special process of decorating plastic dinnerware.

This development marks a new era in the manufacture and sales potentials of plastic tablewares. E. F. Decor's special process magically transforms the practical, down-to-earth look of plastic dinnerware. It opens a vastly expanded market by offering the consumer a choice of imaginative, colorful patterns rather than the traditional solid colors.

For further information write to:

E-F DECOR

DIVISION OF EINSON-FREEMAN CO., INC.
650 South Columbus Ave. • Mount Vernon, N. Y.

Now! VINYL foam ...so versatile, it can be varied to meet your needs!

because it's made of **Firestone**

A totally new foam product with exceptional durability, economy and, most of all, *versatility*—became possible through the development of the vinyl plastisol resin. (Exon 654 in the Firestone line of vinyls.)

Vinylfoam is produced by the Elastomer process, using Exon 654 as the base resin.

Molded in cored or slab form, it can be modified at no extra cost to be as soft or as firm as you need, as light or as heavy, as thick or as thin, as resilient or as "dead."

It can be electronically heat-sealed without affecting any of its properties.

Exon 654 makes Vinylfoam exceptionally resistant to abrasion, corrosion, flame, aging, moisture, tearing and chemical action. With maximum dimensional stability, it resists oxidation, hardening and drying out.

It can be embossed, die cut, split or skived; molded directly onto textiles and most synthetics, and onto vinyl sheeting or film in continuous lengths. Mutual surface impregnation forms a homogeneous bond.

Vinylfoam gives products in almost every field new comfort, safety, durability. Vinyl's economy makes them cost less, sell easily.

EXON

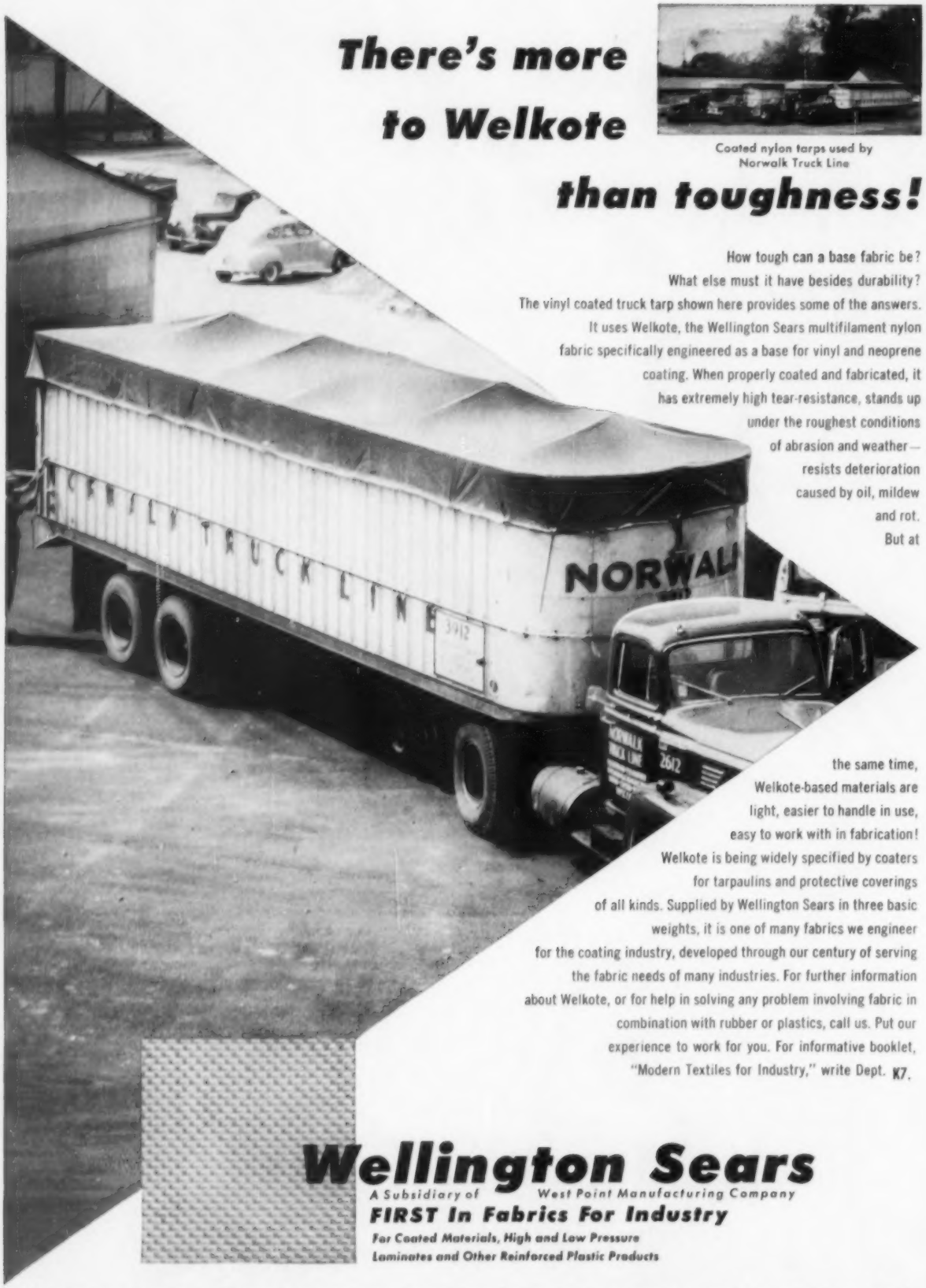
VERSATILE VINYL RESINS
engineered answers to industry's needs

Firestone Plastics Company supplies the plastisol resin for Vinylfoam... does not make the finished foam itself

For complete information or technical service on the entire line of Exon resins, call or write today:
CHEMICAL SALES DIVISION
FIRESTONE PLASTICS CO., DEPT. 62J, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

There's more to Welkote than toughness!

Coated nylon tarps used by Norwalk Truck Line



How tough can a base fabric be? What else must it have besides durability? The vinyl coated truck tarp shown here provides some of the answers. It uses Welkote, the Wellington Sears multifilament nylon fabric specifically engineered as a base for vinyl and neoprene coating. When properly coated and fabricated, it has extremely high tear-resistance, stands up under the roughest conditions of abrasion and weather—resists deterioration caused by oil, mildew and rot. But at the same time, Welkote-based materials are light, easier to handle in use, easy to work with in fabrication! Welkote is being widely specified by coaters for tarpaulins and protective coverings of all kinds. Supplied by Wellington Sears in three basic weights, it is one of many fabrics we engineer for the coating industry, developed through our century of serving the fabric needs of many industries. For further information about Welkote, or for help in solving any problem involving fabric in combination with rubber or plastics, call us. Put our experience to work for you. For informative booklet, "Modern Textiles for Industry," write Dept. K7.

Wellington Sears

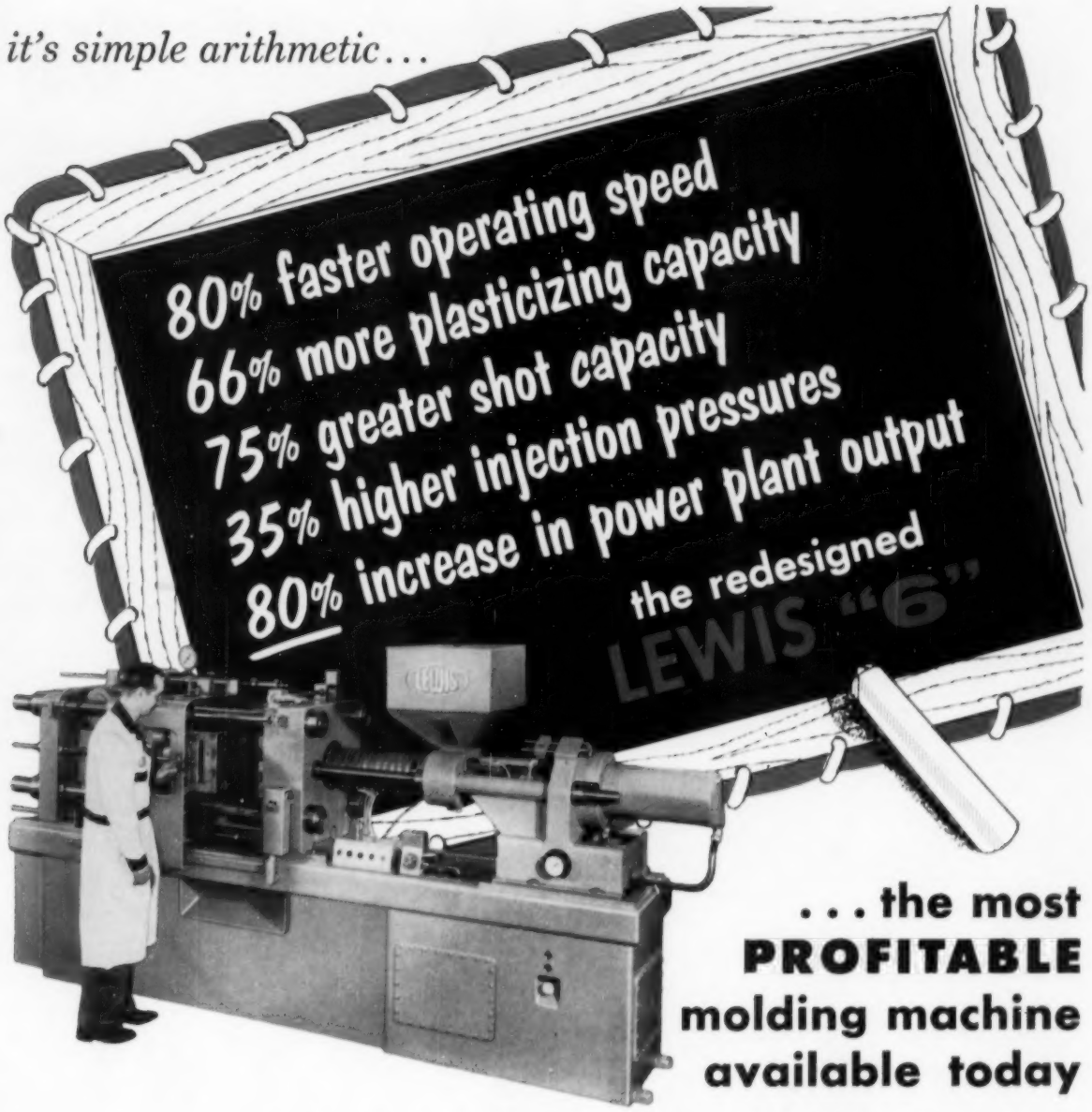
A Subsidiary of West Point Manufacturing Company

FIRST In Fabrics For Industry

For Coated Materials, High and Low Pressure Laminates and Other Reinforced Plastic Products

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

it's simple arithmetic...



...the most PROFITABLE molding machine available today

No matter *how* you figure it . . . in terms of initial investment, versatility, production capacity, quality of moldings, percentage of scrap or operating and maintenance costs . . . the completely redesigned LEWIS Model 616-L-12 is tops in its class.

As the latest development in the LEWIS "6" series, Model 616-L-12 dry cycles 450 times per hour, molds up to 20 cubic inches per shot, plasticizes 100 pounds of material per hour, shoots 12 ounces of polystyrene with pre-packing.

This new LEWIS "6" is engineered for cost and quality-conscious production molders. Dollar for dollar, there's none to compare.

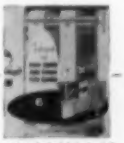
LEWIS

FOR ADDITIONAL DETAILS, WRITE FOR BULLETIN 105 . . . OR CALL KEnmore 1-3040.

THE LEWIS WELDING & ENGINEERING CORP.

MACHINE DIVISION

23002 St. Clair Ave. • Cleveland 17, Ohio



4930-LWM

Lewis Welding & Engineering Corp.
Machine Division
23002 St. Clair Ave., Cleve. 17, O.

Please send BULLETIN 105 describing Model 616-L-12.

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ___ STATE _____

"Poly-Eth" Builds Markets For You:

By showing how polyethylene packages can be re-used at home, this full-page ad dramatizes to the consumer the extra value of polyethylene packaging. This ad is another market-building service of Spencer Chemical Co., makers of "Poly-Eth"* Polyethylene. For information on "Poly-Eth" standard or custom-made resins, write "Poly-Eth," Spencer Chemical Company, 615 Dwight Bldg., Kansas City 5, Mo.

High consumer interest in this ad is shown by the fact that more than 3,000 people have written for this booklet—and inquiries are still pouring in.

This "Poly-Eth" packaging ad appeared in Time and Newsweek Magazines, reaching America's top business and industry leaders.

Polyethylene

AMAZING NEW USES FOR WORLD'S MOST VERSATILE PLASTIC

James May and Customer: "Tuxedo for a fishing trip . . ."

A CUSTOMER recently dashed into The Bachelor's Laundry and Dry Cleaning plant in Kansas City, Mo., and tossed a tuxedo on the counter. "Clean it and press it in a hurry!" he urged Proprietor James H. May. "I'm going on a fishing trip!"

The story, as related to Mark Stringfellow, Manager of Market Development for Spencer Chemical Company, makers of "Poly-Eth"* polyethylene, is only one of many unusual conversations that have taken place since Bachelor's introduced an unique service in the city: its dry cleaning customers now get their clothes back in polyethylene bags. In this case it turned out that the customer was interested, not so much in the tuxedo, as in the bag it would be returned in. He wanted to use the polyethylene bag on his fishing trip as a "ground sheet" to put under his sleeping bag.

● May often sees his polyethylene bags come back as transparent covers on the seats of autos using his shop's drive-through service. They come back, too, as laundry bags left by customers.

WISE HUNCH. Early in his business career, May had a hunch: he believed that more and more Americans would be making their final buying decisions, not because of the product alone, but also because of the package it came in. This would be particularly true, he decided, of highly competitive products and services.

One of the least likely places to prove his point would seem to have been the dry cleaning business Bachelor's added to its laundry operation in 1953. But May was convinced that dry cleaned clothes returned in sturdy, see-through polyethylene bags, at no extra charge to his customers, would attract enough extra trade to more than offset the extra cost to himself. That his plan was sound is indicated by the fact that Bachelor's is now doubling the size of its cleaning plant.

SHIRT TALES. Polyethylene bags are also starring in big-name department stores across the country. With dry goods packaged in tear-resistant polyethylene and set up in super-market style, customers can pick-and-peer to their hearts' content without waiting for a clerk. As a result, they buy more. And—as with May's customers—often they're as excited over the polyethylene bags as over the purchase.

These bags can be used as is, or cut up into sheets. The sheets can be used singly, or joined together by a simple sealing process that takes about a minute.† And in one form or another, they're as useful as Aladdin's genie.

COVER-UP JOBS. In sheet form, polyethylene bags can be used as covers for almost anything — outboard motors, porch or outdoor furniture, records, and household goods; or as garden mulches, book jackets, baby sheets, shower curtains, moth-proof garment bags, transparent slip covers or table cloth covers.

● Traveling men find that even wet shoes or overshoes can be dropped into a polyethylene bag and safely packed in the same suitcase with white shirts. Another bag can hold toilet articles.

● A polyethylene sheet also makes a good temporary pane if a window breaks in bad weather.

DO-IT-YOURSELFER'S PAL. Even the small polyethylene bags in which foodstuffs come are handy in all sorts of ways—such as for storing tools, paint brushes and small parts. Picnickers value such bags as strong, transparent food wrappings and covers. "Poly-Eth" bags can even turn an ordinary jar into a home-made thermos bottle.†

"POLY-ETH" AND YOU. Every day more manufacturers are learning that polyethylene packaging means more sales-compelling appearance and better protection for their products. And, equally important, reusable "Poly-Eth" actually adds to the total value of the product. So look for those products with the plus—"Poly-Eth" packaging. And if you make a product that needs "Poly-Eth" packaging, write to Spencer Chemical Company for information about suppliers who can help you.

†See free Spencer booklet, "58 Home Uses for Free Polyethylene".

Technical Service Manager Gordon Crowe and "Poly-Eth," Spencer's symbol for polyethylene.

*A registered trademark of Spencer Chemical Co.

SPENCER CHEMICAL COMPANY

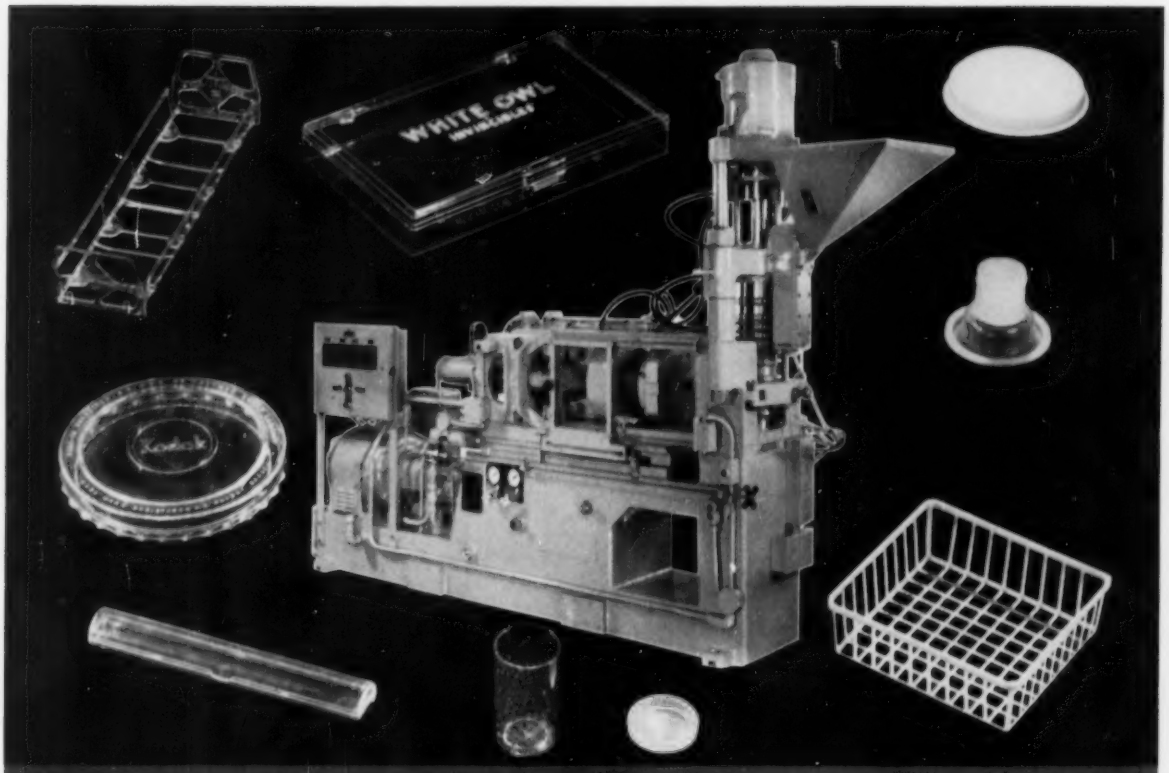
615 Dwight Bldg., Kansas City 5, Mo. Manufacturers of "Poly-Eth" Polyethylene • Ammonia (Commercial and Refrigeration Grade) • Aqua Ammonia • 82% Ammonium Nitrate Solution Synthetic Methanol • Formaldehyde • Hexamine • "Mr. N" Ammonium Nitrate Fertilizer SPENSOL (Spencer Nitrogen Solutions) • FIRETALL (Spencer Dry Ice) • Cylinder Ammonia

FACTS FREE

If you'd like to know more about "Poly-Eth," check the items below in which you are particularly interested. Then mail this coupon to "Poly-Eth," Spencer Chemical Company, 615 Dwight Bldg., Kansas City 5, Missouri. We'll send you more information by return mail.

- ☐ "58 Home Uses for Free Polyethylene"
- ☐ Polyethylene for Packaging
- ☐ Polyethylene Strawberry Mulching
- ☐ Polyethylene Greenhouses
- ☐ Lawn Sprinkler Systems
- ☐ Farm Water Systems

**"Poly-Eth" is a registered trademark of Spencer Chemical Co.



Lester AUTOMATIC
Injection Molding Machines

SHOT CAPACITY	4 OZ.	8 OZ.	12 OZ.	20 OZ.	48 OZ.
Locking Tonnage	125	300	400	600	750
Die Opening (inches)	9 to 6 Adjustable	10	12	14	16¼ or 30
Max. Mold Size (inches)	14V x 18H	23V x 28H	26V x 28H	28¼V x 40H	29V x 50H
Equivalent Bar Size (inches)	3½	6	6½	8	9
Dry Cycle (seconds)	6 at 6" opening	9	12½	13	18 at 16¼" opening

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Highly Loaded Asbestos Floor Tile

Special Low Mol. Wt. Vinyl Copolymer Resin	100 parts	Calcium Carbonate	250 parts
Phthalate Type Plasticizer	20 parts	Titanox RA-50®	10 parts
Adipate Type Plasticizer	5 parts	"Dutch Boy" NORMASAL®	6 parts
Chlorinated Hydrocarbon	10 parts	"Dutch Boy" TRIBASE	2 parts
Asbestos	100 parts	"Dutch Boy" LEADSTAR	1 part

This is a tough, hard, long-wearing stock with excellent dimensional stability. In it, the action of "Dutch Boy" Normasal is specific and unique . . . to prevent color changes from iron or other impurities present in the asbestos. "Dutch Boy" Tribase handles the high fluxing heat. Leadstar aids lubricity.

For heavy-duty tiles... use this highly-loaded "Dutch Boy" Stabilized vinyl stock*

Moderately Loaded Asbestos Floor Tile

Vinyl Copolymer Resin	100 parts	Titanox RA-50	25 parts
Dioctyl Phthalate	60 parts	"Dutch Boy" NORMASAL	7 parts
Epoxy Plasticizer	10 parts	"Dutch Boy" CLARITE A	2 parts
Asbestos	140 parts	"Dutch Boy" CALSTAR	0.50-0.75 parts
Calcium Carbonate	130 parts		

A high gloss, resilient stock suitable for vivid coloring. As in the heavy-duty stock, Normasal prevents reactive color changes. "Dutch Boy" Clarite A teams up with "Dutch Boy" Calstar to provide heat and light stability plus lubricity without adding to opacity.

For beauty-duty tiles... use this moderately-loaded "Dutch Boy" Stabilized vinyl stock*

Asbestos-free Floor or Wall Tile

Vinyl Copolymer Resin	100 parts	"Dutch Boy" CLARITE A	2 parts
Dioctyl Phthalate	35 parts	"Dutch Boy" CALSTAR	0.50-0.75 parts
Epoxy Plasticizer	5 parts		
Filler	200 parts		

This is a standard, asbestos-free stock with excellent flexibility suitable for walls and other light wear applications. "Dutch Boy" Clarite A and Calstar again team up to give this stock smooth processing characteristics and permit vivid coloring.

*Modify as called for by pigmenting requirements.

For light-duty tiles... use this asbestos-free "Dutch-Boy" Stabilized vinyl stock*

Outpace the flooring market on *color* with these 3 "Dutch Boy" Stabilized stocks

...one to build up and preserve color in each standard type of tile or cove molding

"Dutch Boy" Stabilizers do three things for color in highly filled vinyl flooring stocks.

First, they prevent color shifts caused by high processing heat. Second, they prevent changes in hue caused by sunlight and colorant reactivity with resin degradation products. Third, they broaden the range of color choice.

The formulations illustrated show how "Dutch Boy" Stabilizers combine to improve color in typical flooring stocks. For additional information, write National Lead's Technical staff.

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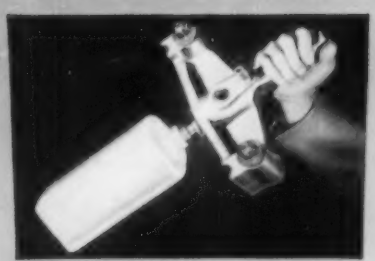
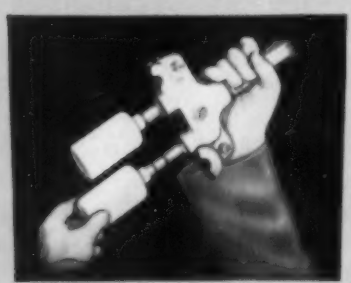


Blow stick showing 2 litre square bottle



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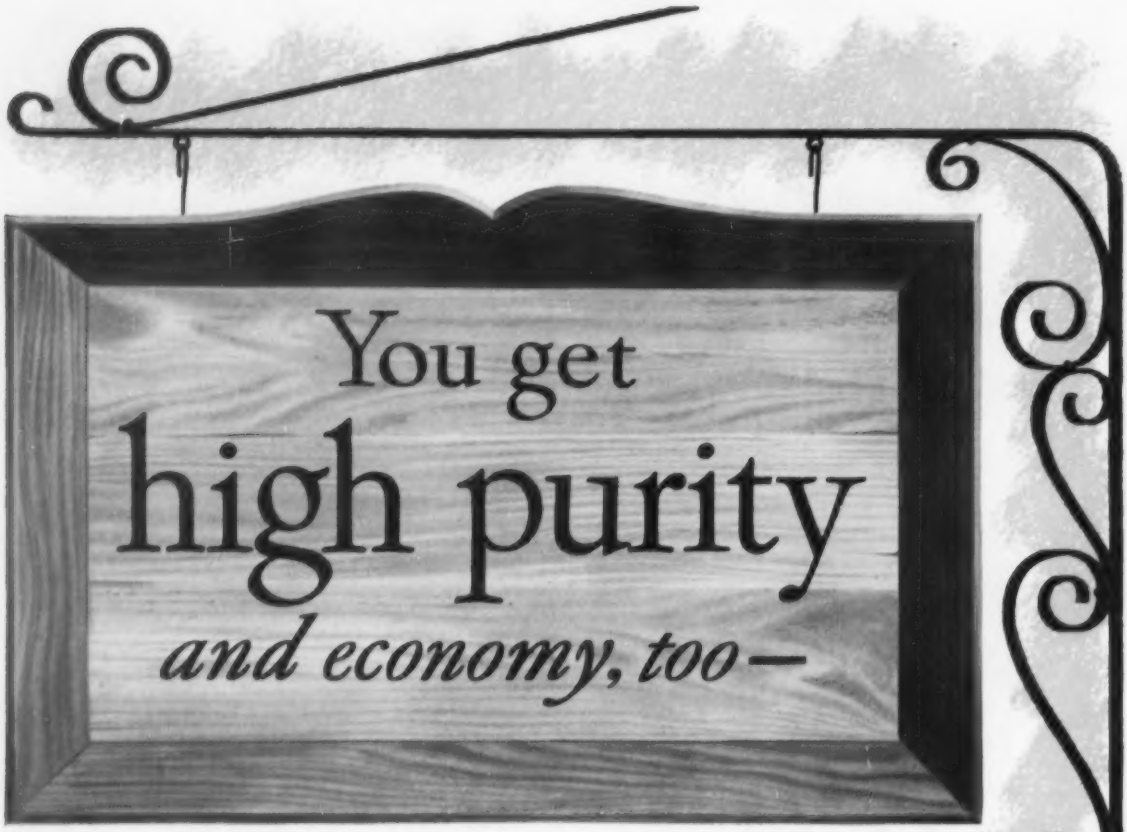

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SHELL

The Plastiscope*

July 1956

News and interpretations of the news

By R. L. Van Boskirk

Section 1

More high-pressure polyethylene. Du Pont has made a big move to confound the experts who once predicted that no more high-pressure or conventional-type polyethylene plants would be built. The company has announced that its present capacity for producing high-pressure polyethylene will be doubled by early 1958. Expanded capacity of present facilities (estimated at 100 million lb.) and a new plant at Orange, Texas, will account for the increase. Periodic increases from present facilities will start coming in by September of this year. A great part of the new capacity will be for Du Pont's new high-density resins which came into production last March and which have aroused unusual interest because their heat resistance and stiffness properties approach those of the new low-pressure polyethylenes. Already great quantities are going into film used in packaging soft goods because of the material's superior clarity. Other uses are growing rapidly. Du Pont is also working on pilot-plant testing for their linear or low-pressure polyethylene, but there is no evidence that even a site has been suggested for a plant to produce linear-type polyethylene.

Effect of auto production on plastics. In 1955 the 7,900,000 passenger cars produced are estimated to have used around 85 million lb. of plastics. That's about 11 lb. a car. If the present rate of production of cars, about 23% under last year, con- the last CMRA meeting said it may be 1960 before production gets back to 8 million. Six million cars at present plastics consumption per car would tinues, the production will be around 6 million. Chemical market analysts at represent about 65 million pounds. First five months' production of cars was 2,776,813 in 1956 compared to 3,624,100 in 1955—a loss of 9,300,000 lb. in plastics. The above figures are exclusive of the 30 million or more lb. of paint and lacquer resins used by the auto industry in 1955. Since the plastics industry sold around 3 billion lb. of resin in 1955, exclusive of paint resins, these figures are not particularly alarming from an over-all viewpoint.

Methacrylate, nylon, phenolic, etc. Methacrylate has been perhaps the hardest hit by auto production. At 1½ lb. or thereabouts per car, a decline of 2 million cars in 1956 could mean a loss of 3 million lb. in molding powder sales this year, which is a real sizable decline in a total estimated production volume of some 20 million pounds. Methacrylate molders have been singing the blues for weeks. Sales to auto manufacturers are 50 to 60% of all methacrylate moldings. Some molders are engaged almost exclusively in such production and the situation is worsened because inventories were high. Nylon is now averaging almost

*Reg. U.S. Pat. Off

½ lb. a car, but there are not too many nylon molders selling nylon parts for autos. Besides, the number of applications per car is growing and inventories for nylon parts don't pile up as they do in methacrylate—orders seem to be more evenly distributed. Phenolics, including laminates, are used at somewhere near 2 lb. a car—loss hurts, but not too much. Cellulose acetate butyrate volume supposedly averages a little less than 1 lb. a car—loss in volume is aggravated by threatening competition from other materials for steering wheels. Styrene-type rigid and flexible sheet volume for autos was probably 10 million lb. in 1955—may not decline much in 1956 because of increased use per car.

Vinyl chloride for automobiles. Estimates on the amount of vinyl chloride used in automobiles in 1955 vary from 3.8 to 6 or more lb. per car. The trouble in estimating is that some models used much more than others. The part used for upholstery may decline slightly per unit this year due to introduction of more mixed varieties of upholstery on various models. This 30 to 50 million lb. of vinyl chloride used by the auto industry is a relatively small part of the vinyl industry's total 1955 sales volume of 427 million lb., but the amount used by the auto industry is concentrated in the hands of a relatively few calenderers, coaters, and extruders. The particular operators started squirming over loss of business in March—most of them don't expect a sizable pick-up until the last quarter of 1956. They are hurt not only by the auto decline in units, but by large inventories now in the hands of automobile manufacturers.

Phillips polyethylene license in Germany. Phillips has marched right into the heart of its chief rival's country by licensing Badische Anilin und Soda-Fabrik of Ludwigshafen/Rhine, Germany, to make linear or low-pressure polyethylene and other polyolefins by the Phillips process. Germany is the country of Prof. Karl Ziegler, developer of the famed Ziegler catalytic process for low-pressure polyethylene. The two processes are somewhat similar, but each claims superior properties. Phillips is said to use chromium salts on an alumina-silica carrier as a catalyst. Ziegler is said to use aluminum alkyls as a catalyst. Both claim processing and property advantages, but both have the problem of introducing and removing solvents. B.A.S.F. is also producing high-pressure polyethylene under an I.C.I. license. Phillips now has four licensees in the U. S. and six overseas. Another U. S. firm is a possibility. Ziegler has eight licensees in the U. S. in addition to various foreign contractors. There are eight I.C.I. licensees in the U. S.

Vacuum forming patents. The Federal District Court of Chicago has held the two Borkland patents invalid for lack of invention. There is no word as yet as to whether Borkland will appeal.

Urethane sheet. National Aniline put on a two-week demonstration at Grand Central Station, New York City, to show Mr. and Mrs. John Doe how easy it is to make urethane foam—if you know how. An interesting supplement to the foam demonstration was a display of a solid urethane elastomer sheet which is produced in the same way as the foam, except that no water is added during polymerization. An important property is that the solid sheet—still in the laboratory stage—can be dry cleaned. Some time this fall the company will open a "Urethane House" in Buffalo, N. Y., where such things as cushioning, wall covering, tile, rug underlay, and other urethane products will be emphasized.

National Aniline has also reduced the price of Type 80 isocyanates from $1.05 to 99¢ a lb. and will supply blueprints of necessary machinery to those interested in making the foam.

Predictions for foam. Highly interesting predictions on uses and market potential for various foams are printed in a recent study of the polyurethane industry by students of the Harvard University Graduate School of Business Administration. Here are some of the teasers, in which the first figure represents 1955 consumption in millions of actual lb.; the second represents 1960; and the third represents 1965: latex—235, 297, 256; vinyl—4, 79, 206; urethane—2, 51, 131. In millions of pounds of foamed material, the figures would be: latex, 235, 297, 256; vinyl, 5, 105, 274; urethane, 5, 128, 327.

Urethane foam for autos. The same source quoted above says one auto manufacturer expects that the majority of its 1956 cars will be equipped with urethane crash pads, with 1 lb. per unit to be used. But the authors also state that Detroit is not being taken by storm; it is studying each foam for competitive advantages. Eventual range of urethane foam in cars may be anywhere from 1 to 25 pounds. One auto manufacturer now has an experimental model seat that would eliminate springs and use 13 lb. of urethane per car. The above information is excerpted from the Harvard study which runs 115 pages in a comprehensive treatment of the subject. It can be obtained for $10 by writing P.O. Box 98, Cambridge 38, Mass.

Polyethylene sales in second quarter. Polyethylene reached a sales volume of 42 million lb. in March, which would be a 500 million-lb. annual rate—but conservative observers don't believe that 500 million lb. will be sold in 1956. Enthusiasts think the total will be more. The 1955 figure was 345 million. March sales may have been inflated because notice had been served that prices of some pipe- and electrical-grade resins were going up in April. Estimates now are that total sales in April and May were between 35 and 40 million lb.; June and July may be lower, but volume may begin to go well over 40 million lb. again, starting in August. Film sales reached their peak in March, a month earlier than usual. Seasonal decline is expected through summer until September. Pipe sales follow about the same pattern. Huge export sales may upset the pattern, but no figures are available.

Improved weather resistance for plasticized vinyl. Researchers at Monsanto Chemical Co. have developed a stabilizing system which they believe may more than triple the weathering qualities for certain types of vinyl chloride applications. The new system has withstood 5600 hr. of accelerated artificial weathering. A standard stabilizing system heretofore lasted 1000 hours. Outdoor tests for the new system have not been completed although the formula has been under observation for about two years. The long weathering tests were conducted with 40-mil transparent sheeting. Thin film is more difficult to stabilize by this method, but the problems involved are still under study. Present application goals are such items as garden hose, wire coating, and other extrusions, plus floor covering. The four parts of the stabilizer system are barium-cadmium, epoxidized oil, an antioxidant, and an undisclosed organic additive which is the key gimmick. A suggested formulation would be 100 parts P.V.C.; 30 of D.O.P.; 17 of S-141 plasticizer; plus the stabilizer system consisting of 2 parts of barium-cadmium; 3 of G-62; 0.1 to 0.75 of antioxidant; and 2 to 0.1

of organic additive. S-141 is a 34¢ Monsanto phosphate plasticizer that is both non-toxic and flame resistant. It may be used in varying amounts to replace as little or as much D.O.P. as desired, but the Monsanto research work has naturally involved the use of its own plasticizers. Monsanto has patented the use of the four constituents as a stabilizing sytsem for plasticized vinyl formulations but sells none of them.

Plasticizer to reduce "tack." Monsanto has also introduced a new phthalate-type plasticizer, Santicizer 213, which helps reduce the grip of vinyl chloride surfaces. It is particularly useful in permitting an easy "slide" across vinyl upholstery, eliminates the need for interleaving in rolls of film, prevents gripping of a vinyl-surfaced product to the walls of cellophane and polyethylene bags when packaged, and "slicks" the surface of electric wire coatings. A 40% content of 213 in a formulation gives a Shore hardness of 82 compared with a 73 hardness when a 40% content of D.O.P. is used. It can be used alone as a plasticizer but performs better in combination with others, although a 25% minimum concentration of 213 is desirable. It is more volatile than D.O.P. and will fume moderately on a calender or roll mill, but these problems can be overcome by proper blending. In addition to minimizing the "tack" problem, 213 imparts low initial viscosity to plastisols, improves fusion characteristics, gives added gloss to coated, molded, and extruded products, and improves mold release in slush-molding operations.

Export totals for vinyl. The Bureau of the Census Report No. FT410 gives some interesting figures on plastics exports for 1955. Here are a few of them: Vinyl chloride and copolymer resins, uncompounded, 35 million lb.; compounded vinyl, 15 million lb. The United Kingdom was the largest customer with 13.5 million lb.; Canada took 13 million lb.; and Mexico, 2 million lb. of uncompounded resin. The same countries were the largest customers for compounds, too; Korea and South Africa were also large buyers of compound and purchased very little straight resin. Odd item was that Italy ranks seventh among all importers of vinyl with over ½ million lb. of straight vinyl, yet that country was also largest exporter of vinyl resins to U. S.

Polystyrene exports. The same government source quoted above listed styrene polymer and copolymer resins (60% or more styrene) exports at 44 million pounds. Largest customers were Japan, 7.5 million lbs.; Canada, 4; France, 3.4; Netherlands, 2.4; Venezuela, 2.3.

Polyethylene for construction. Building and highway applications are potentially the largest volume uses ever suggested for polyethylene film. Spencer Chemical tells why in a terse summary. Some of the reasons for its value to the building and construction fields are: light weight—1000 sq. ft. of 2-mil film weighs less than 10 lb.; it seals against dust and drafts; it is easy to handle and saves labor cost; it is inexpensive—enough film to seal off the crawl space under a house (1100 sq. ft. of 4-mil material) costs less than $15; it provides a moisture barrier between concrete slab and wooden floor; it seals an exterior foundation wall against leaks; and it serves as a moisture barrier in side walls. Spencer furnishes a list of all polyethylene extruders along with the summary on building and highway applications of polyethylene film.

For additional and more detailed news see Section 2, starting on p. 204.

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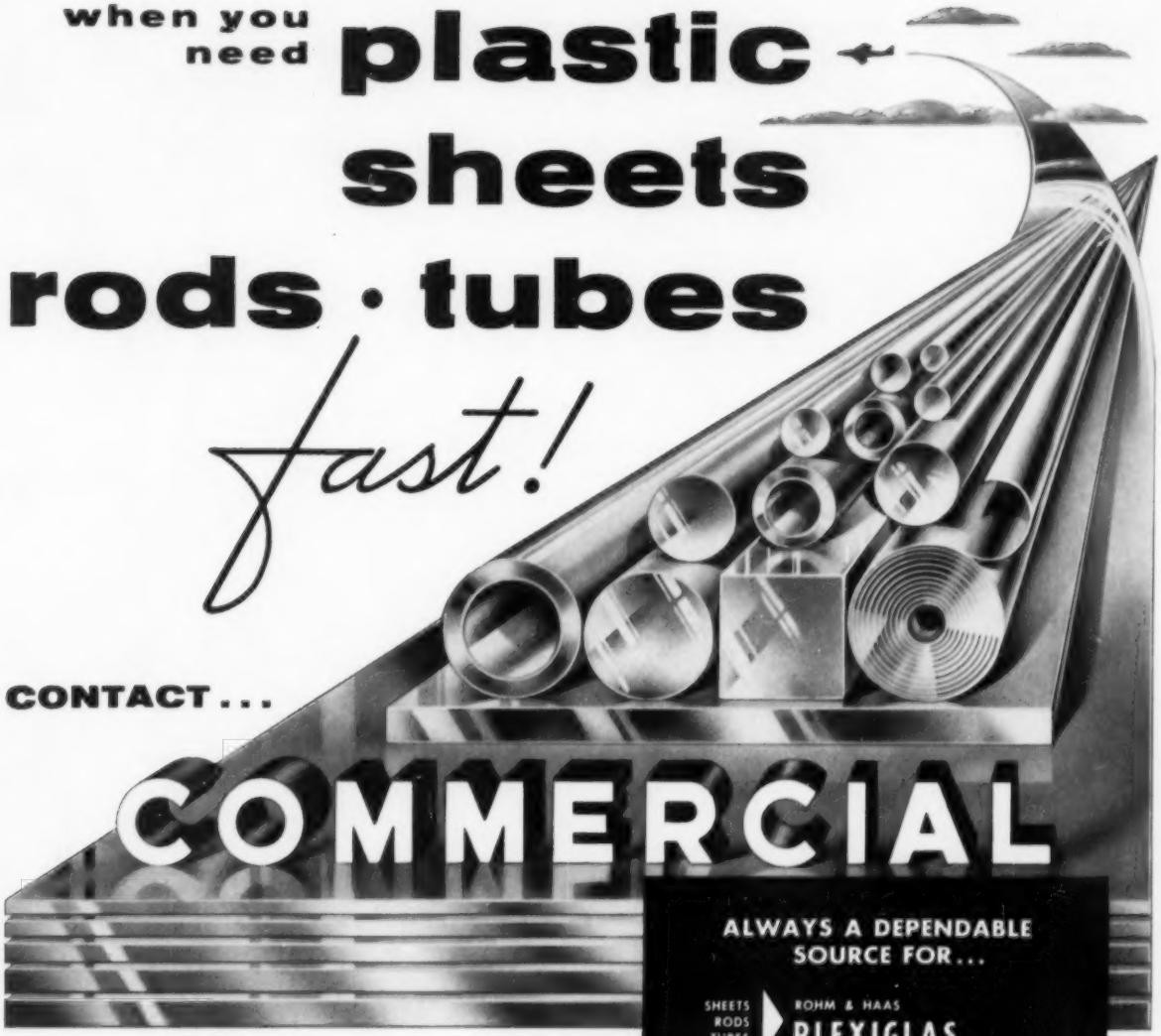

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. . dashboard light lens Originally this part was designed as a clear lens. Later, when the specifications were changed to call for a translucent lens, the customer suggested that either the mold, or the clear parts, be sandblasted. . either process would have increased costs. Richardson suggested, instead, a special light-transmitting polystyrene. Result: 15% reduction in lens cost.

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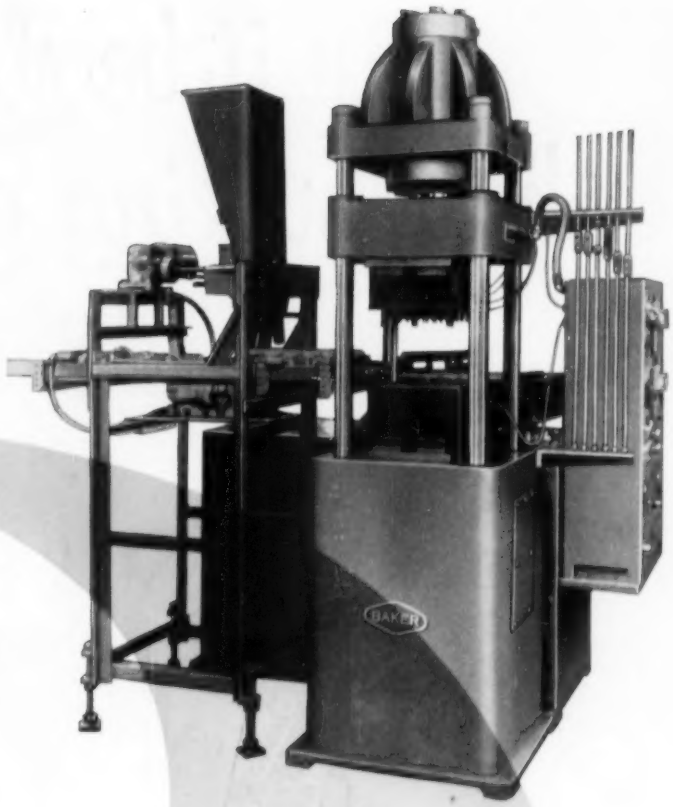

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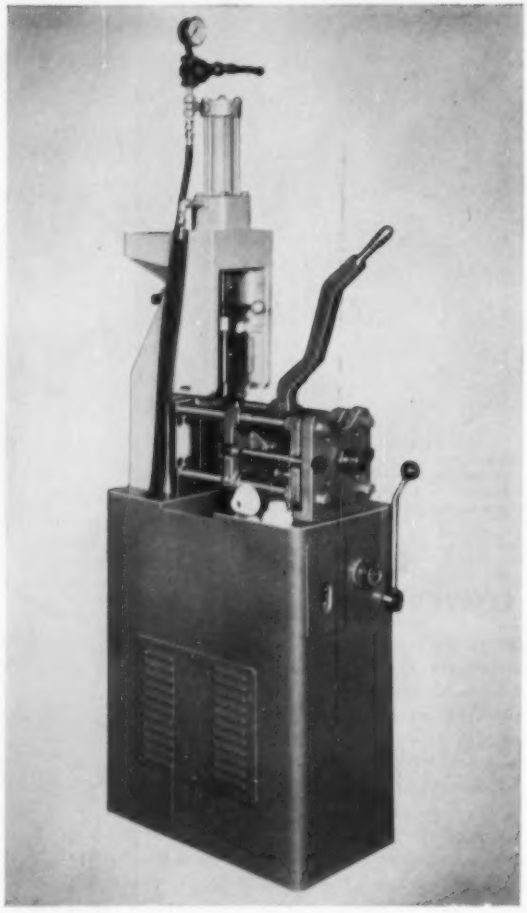
Here are the small thermoplastic injection molding machines that do a small job in a big way! Economical to operate and low in cost, these ¾ ounce plastic injection molding machines are turning out thousands of small plastic items every day for hundreds of satisfied users. Molds any thermoplastic . . . including Nylon. The Mini-Jectors are the most versatile machines in their class. Simple and compact in design, Mini-Jectors operate easily and efficiently and owners everywhere find they pay for themselves many times over.



MODEL 60 "HORNET" ¾ oz. injection capacity. Mold size 6" x 5" x 5⅛". Will plasticize 5½ lbs. per hour. Hydraulic injection system, also available for air operation . . . semi-automatic knockout speeds operation and mold change.

MODEL 45 "WASP" ¾ oz. capacity air-operated Mini-Jector . . . fast and economical. 6" air cylinder operates ram . . . 40 to 150 pounds of air pressure required depending on type of plastic used and product being molded. Material hopper capacity 4 pounds.

Mini-Jectors are small production machines. They offer the most economical way of injection-molding small plastic articles (¾ oz. or less) where there is no need for high-speed production.

In addition, Mini-Jectors are ideal equipment for developing new plastic products. You can make up a few dozen, several hundred, or thousands in the exact color and design to test market reaction before you tool up for full production. In many cases, the Mini-Jector will take care of the entire production requirements.

Any Thermoplastic including NYLON may be molded with a Mini-Jector.

EVERY DAY THOUSANDS OF ITEMS ARE BEING PRODUCED PROFITABLY ON THE MINI-JECTOR.

WRITE TODAY for free literature that will tell you how you can use the Mini-Jector to solve your injection molding problems.

NEWBURY INDUSTRIES 202 Munn Road, Newbury, Ohio

Specializing in the Production and Development of Plastic Injection Molding Machines of One Ounce or less Capacity.

can plastics

improve your product?
decrease your cost?
increase your sales?

Let AMOS provide the answer—

New applications of plastics become practical daily with continued improvement in materials, production equipment, molding and finishing techniques.

• • •

HAVE YOUR PRODUCTS BEEN CURRENTLY SURVEYED by competent plastics engineers to determine if latest developments and techniques make applications for *you* practical?

Amos offers complete product development facilities . . . from the original art renderings to the finished plastic part or assembly.

Amos will be glad to review your product and tell you if plastics can serve. It's the sure way to find out what plastics can do for *you*. Contact Amos today!

AMOS MOLDED PLASTICS · EDINBURG, INDIANA
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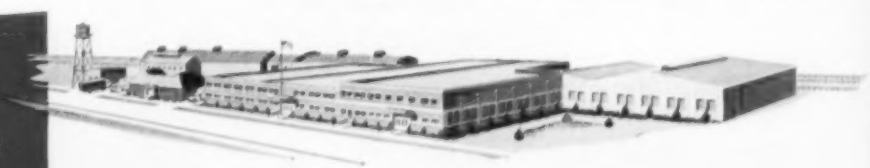

CUSTOM INJECTION MOLDING & FINISHING

Thin wall clear polystyrene containers are formed in this mold of CRUCIBLE CSM 2. Mold Builder: Standard Tool Company, Leominster, Mass.

they picked ultrasonically inspected

CRUCIBLE CSM 2

from warehouse stocks

FOR HIGHER FINISH . . . LONGER MOLD LIFE – It takes a highly polished and dimensionally accurate mold to form clear styrene into these thin walled containers. And, because production-runs go into the millions, the mold steel has to be long lasting. Both are good reasons why CRUCIBLE CSM 2 was selected.

For CRUCIBLE CSM 2 is an exceptionally *clean* steel—uniform in composition and structure—with superior machining and polishing characteristics. And for absolute dependability, *every piece* of CSM 2 is ultrasonically inspected.

What's more, for your convenience, CSM 2 is immediately available from Crucible *warehouse stock* in 205 sizes. Next time you need mold steel—call Crucible. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

For Plastics – go to Worbla

Manufacturers of plastics for over thirty years.

WORBLA-PLASTICS have proved their worth

So that you may see for yourself — we shall gladly provide you with samples.

WOPALOID

Celluloid in sheets, tubes and rods.

WOPALON

Cellulose Acetate in sheets, tubes and rods.

WOPALIT

Acetate powder for injection molding and extrusion.

WOPAVIN

PVC (Polyvinylchloride) in calendered and pressed sheets, tubes, rods and profiles. Compounds for injection molding and extrusion.

WORBLA

Nitrocellulose for lacquers and technical uses.
Bleached linters.

WORBLA LTD.
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Battelle Memorial Institute
Bauer and Black
Division of the Kendall Company
Godfrey L. Cabot, Inc.
Celanese Corporation of America

Here are 30 VOTES OF APPROVAL

for Farrel's "new-style" LABORATORY MILL

Dow Chemical Co.
E. I. Du Pont De Nemours & Co., Inc.
Durez Plastics & Chemicals, Inc.
Esso Research & Engineering Co.
Esso Standard Oil Co.
General Electric Company
General Tire & Rubber Co.
Harshaw Chemical Co., Inc.
Interchemical Corporation
Johns-Manville Research Center
The Kerite Company
Koppers Company, Inc.
Linde Air Products Co.
Merck & Co., Inc.
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Proctor & Gamble Co.
Remington Arms Company, Inc.
Shell Chemical Corporation
Spencer Chemical Co.
U. S. Rubber Company
University of California
R. T. Vanderbilt Co., Inc.
Western Electric Co.
Westinghouse Electric Corporation
Witco Chemical Co.

Method of Speed Control	No. of Motors	HP Each Motor	Friction Ratio	Roll Speed (RPM) Front	Roll Speed (RPM) Back
Constant	1 (AC)	7½	1.4:1	23.5	33
Vari-pitch Pulley	1 (AC)	7½	1.4:1	13 to 24	18 to 34
Vari-pitch Pulleys	2 (AC)	5	Variable	20 to 38	18 to 34
Adjustable Voltage	2 (DC)	5	Variable	4.5 to 34	6 to 45

You can get an idea of the popularity of Farrel's two-roll, 6″ x 13″ lab mill from that *partial* list of users. A number of these big names in industry have sent in repeat orders for one or more additional mills.

One reason for this wide acceptance is that, in standard form, the mill comes with four different drive arrangements (see chart). One of these should give *you* exactly the roll speed or speeds, and friction ratio you need for experimental work.

Another reason is that, although these mills are basically standard, they can be tailored to suit any manufacturer's requirements with the choice of many design features.

Send for further information about this versatile mill, or ask to see a Farrel engineer about your laboratory equipment problems.

FARREL-BIRMINGHAM COMPANY, INC.
Ansonia, Connecticut

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Fayetteville (N. C.), Los Angeles, Houston

FB-1049

Farrel-Birmingham®

Diamond calcium carbonate fillers do more than save money

Sure, you can shave your costs* by filling glass-reinforced polyester resins with precipitated calcium carbonates. But just as important—in a quality-demanding market—is the fact that DIAMOND fillers help turn out products with these improved properties:

Smooth surfaces

Surfaces of *filled* reinforced polyesters are definitely better than those that aren't filled. Glass fibers are hidden. Deep cracks in resin rich areas are eliminated.

Controlled viscosity

Unfilled resin tends to flow from between closed match dies. You waste resin. Filled resin, because of its higher viscosity, stays within the mold's confines. Using the proper DIAMOND filler, you can control the viscosity and give the resin a body most suitable for the operations involved.

Decreased shrinkage

Fillers greatly reduce the shrinkage occurring during polymerization.

Greater wet strength

After immersion in water for seven days, filled polyesters show less loss in physical properties than unfilled ones do.

More even cooling rate

Polyester resin cools five to six times faster than glass fibers. This makes the fiber pull away from the resin, particularly at the surface. You get a surface that's difficult to paint. A precipitated calcium carbonate helps the resin mix and the glass fibers cool at a more even rate. The surface is smoother, easier to paint.

These improved properties reduce rejects and eliminate "touching up."

What fillers? DIAMOND suggests these four:

Surfex® MM—Particle size: 1 to 5 microns. Resin coated. Oil absorption 20-22 cc per 100 grams. Maintains low viscosity for a given filler concentration. Wetted very easily by resin.

Kalite®—Particle size: about 1 micron. Oil absorption 28-32 cc per 100 grams. Recommended for draw work.

Suspenso®—Particle size: 1 to 5 microns. White. Uncoated. Oil absorption 20-22 cc per 100 grams. Use in applications where pot life is critical. Eliminates crazing in resin rich areas.

Multifex® MM—Particle size: .05-.06 micron. Uncoated. Gives reinforced plastic a smooth white, nonporous finish. Requires less extra work after molding. Little buffing required.

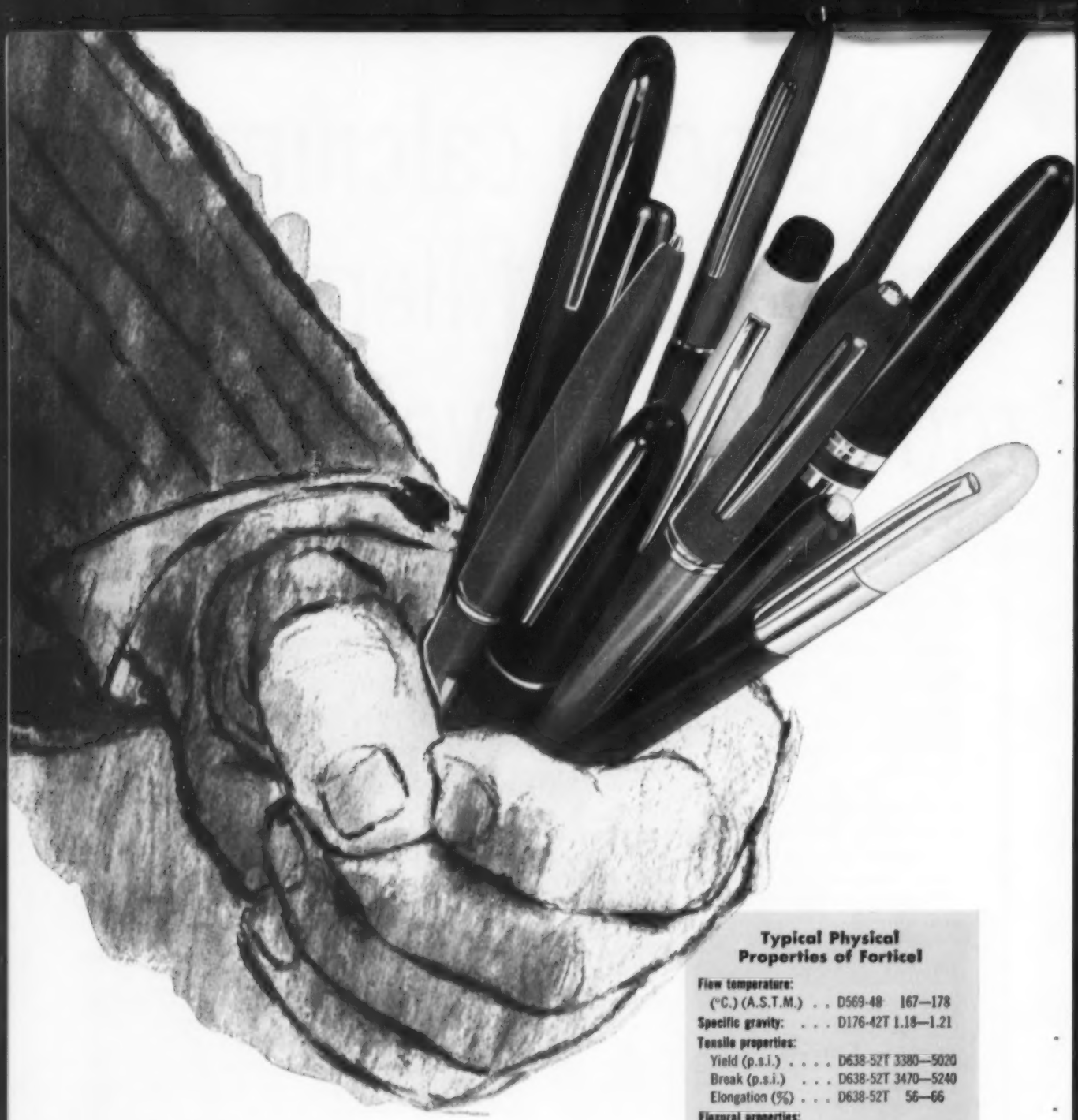
*Your nearby DIAMOND sales representative can show you money-saving formulas and detailed cost comparisons. Or ask for Bulletin No. 8. Write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

Diamond Distributors: Carmona & Hawxhurst, San Francisco; Dorsett & Jackson, Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada), Ltd.

DIAMOND CHEMICALS

Diamond Chemicals



Typical Physical Properties of Forticel

Flow temperature:		
(°C.) (A.S.T.M.) . .	D569-48	167—178
Specific gravity: . . .	D176-42T	1.18—1.21
Tensile properties:		
Yield (p.s.i.)	D638-52T	3380—5020
Break (p.s.i.) . . .	D638-52T	3470—5240
Elongation (%) . . .	D638-52T	56—66
Flexural properties:		
Flexural strength (p.s.i. at break) . . .	D790-49T	6400—8500
Flexural modulus (10^5 p.s.i.)	D790-49T	0.23—0.30
Rockwell Hardness:		
(R scale)	D785-51	62—94
Izod Impact:		
(ft. lb./*in.* notch) . .	D256-43T	2.7—11.0
Heat distortion:		
(°C.)	D648-45T	59—70
Water absorption:		
% Sol. lost	D570-42	0.00—0.08
% Moisture gain . .	D570-42	1.5—1.8
% Water absorption .	D570-42	1.6—1.8

Celanese Corporation of America, Plastics Division,
Dept. 101-G, 290 Ferry Street, Newark 5, N. J.

Send me New Product Bulletin NP-16 on Forticel Plastic.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

You could call FORTICEL *the "write" plastic!*

New Celanese Molding Thermoplastic offers unique balance of properties for wide range of product manufacture

Today, America's most popular fountain pens and mechanical pencils are being made of Forticel. And this has happened within months of the introduction of this brilliant, new Celanese Plastic!

For the same reasons that Forticel is the *right* plastic for everything from automobile arm rests to portable radio cabinets. Forticel has overnight become the accepted plastic in the writing instrument field.

Consider these Forticel advantages as the penmakers do:

- **Durable Surface Lustre**
- **Brilliant Molded Finish**
- **Wide Color Range**
- **Dimensional Stability**
- **Form Retention**
- **Superior Toughness**
- **Good Weatherability**
- **Superior Moldability**
- **Machinability Without Cracking or Crazing**
- **Freedom From Objectionable Odor**

Forticel combines in a single materi[illegible]aps the best balance of properties of any thermoplastic. What the penmakers have discovered it can do for their precision products, is indicative of what it can contribute to product improvement in a variety of fields: automotive, electrical, personal items, toys and sporting goods.

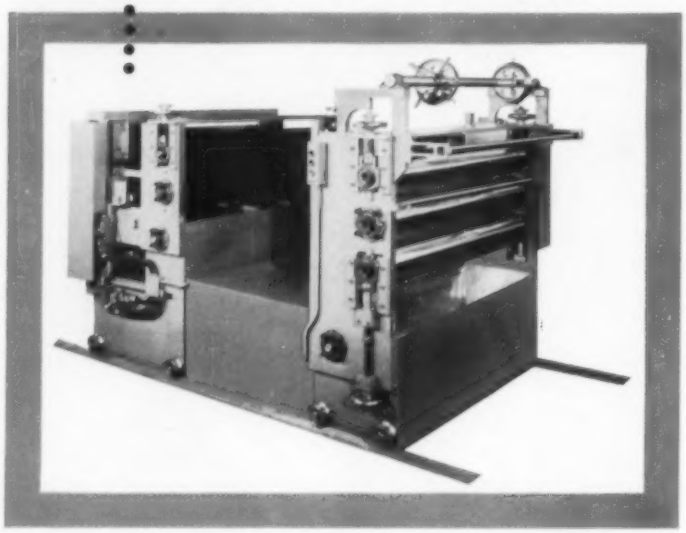
If you haven't already evaluated the new Forticel, send for Product Bulletin NP-16. Use coupon. Celanese Corporation of America, Plastics Division.

Celanese plastics

Celanese® Forticel®

Robbins

creative thinking
plus
creative engineering
gives you the latest
in **package** *sheet*
haul-off equipment



ROBBINS HAUL-OFF UNIT AND SHEAR COMBINED...

This newest ROBBINS Combination is being used for production of top quality sheet and laminating. This combination mounts on base rails and comes equipped with the rails and ball-bearing rollers for easy movement. Either or both bottom and top chrome rolls can be made adjustable. Laminating rolls can be set in most practical position for any specific operation. Sub-Base can be furnished with unit so that you can feed through the bottom and middle roll. Variable speeds on all units. Used with other ROBBINS individual units or special attachments, this latest ROBBINS Combination has the flexibility to meet your requirements. Robbins dies and haul-off equipment can be used with practically all makes of extruders now on the market.

- ★ *CHROME HAUL-OFF ROLLS*
- ★ *RUBBER PULL ROLLS*
- ★ *TRAVELING AUTOMATIC SHEAR*
- ★ *AUTOMATIC SCRAP CUTTING*

Sheeting Dies • Stacking Units • Split Base Sheeting Units • Wind up Units • Profile Dies • Pipe Dies • Water Tanks • Pipe Pull-Offs • Pipe Coiling Machines • Automatic Cut-Off Saw Conveyors

Robbins
never say die... say Robbins die

PLASTIC MACHINERY CORP.

1430 MISHAWAKA STREET • • • ELKHART, INDIANA

Sheeting Dies A Specialty

Those whose business is Plastics

use controlled* colors by adp

ADP colors are *true* . . . and *uniform* in *every* batch.
ADP dispersions go *much* further than those made by other methods . . . so your end product costs less.

ADP colors will not agglomerate in the compound or the finished product. They cut compounding time; save your equipment; save you hours of clean-up time.

ADP specialists, technically trained in the manufacture and use of color dispersions in the plastics industry, are available for consultation without obligation. They will tell you how and why ADP controlled colors make better plastic products at lower manufacturing cost.

*Because ADP dispersions are colloidal in nature, with pigment particles of microscopic size.

100th Anniversary

1891—SILICON CARBIDE
1895—SYNTHETIC GRAPHITE
1906—COLLOIDAL GRAPHITE

ACHESON DISPERSED PIGMENTS CO.

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SYLVANIA TUNGSTEN COILS

for Vacuum Metallizing

Whether your vacuum metallizing operations are small or large—Sylvania tungsten heater source coils bring you dependable performance at minimum cost.

Manufactured under exacting standards of uniformity and high metal purity, these Sylvania heater coils are designed expressly for vacuum metallizing. Special tungsten wire is stranded and coiled to specifications established through Sylvania's own experience in the production of reflector lamps, as well as the experience of others. You are thus assured of both maximum evaporating capacity and long service life.

Sylvania offers you a wide selection of ready-made tungsten coils, in single or multiple strand, each intended for a particular vacuum metallizing application. Whenever you encounter coil application problems, our engineers will gladly help you work them out.

Write for your copy of "*New Process Sylvania Tungsten Coils and Strand*," presenting application and performance data.

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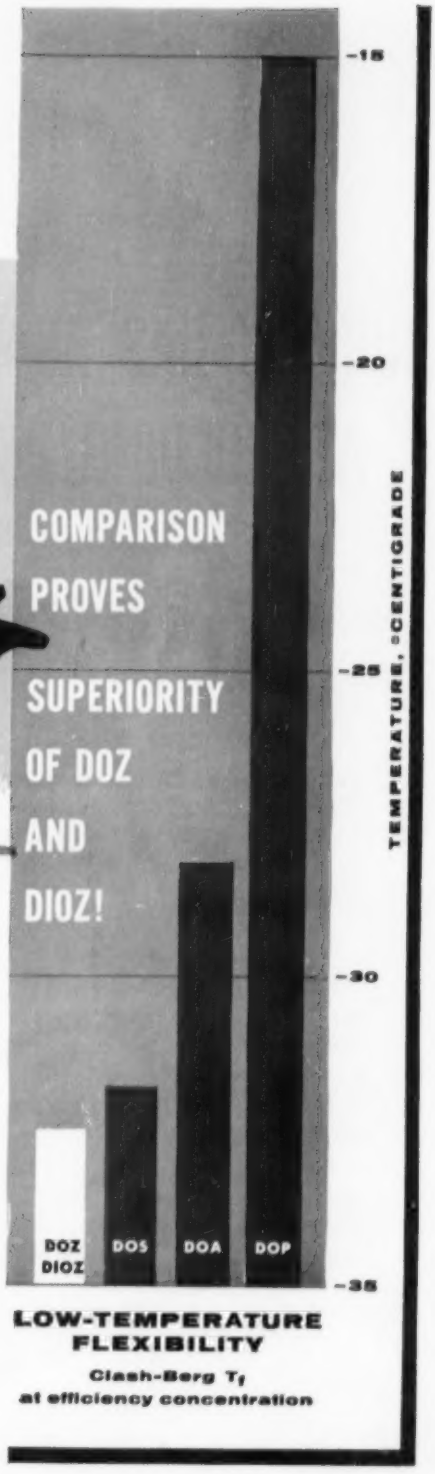
LOW TEMPERATURE FLEXIBILITY



SPECIFY PLASTOLEINS® 9058 DOZ AND 9057 DIOZ

Eskimos and their low-temperature problems aside—what about yours! Fabricators of plastic items will be more receptive to your vinyl products if you can offer them superior low-temperature flexibility . . . like that provided by Plastoleins DOZ and DIOZ.

In addition, these Emery Plasticizers give many other advantages to calendered and cast films, calendered sheeting, calendered and dispersion coated fabrics, and extruded products. They provide low volatility, low water extraction, excellent heat and light stability, high plasticizing efficiency and extremely low soapy-water extraction.

Find out how you can make your products more attractive sales-wise. Today, write to Dept. F7 for descriptive literature and samples of Plastolein 9058 (di-2-ethylhexyl azelate) or Plastolein 9057 DIOZ (di-iso-octyl azelate).

Emery

Fatty Acids & Derivatives
Plastolein Plasticizers
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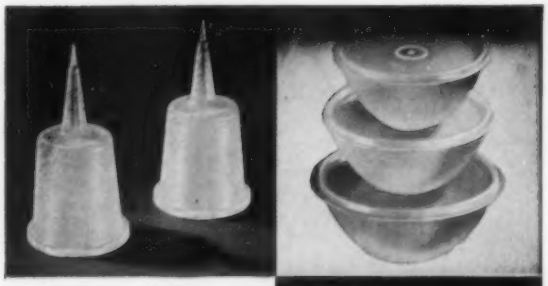
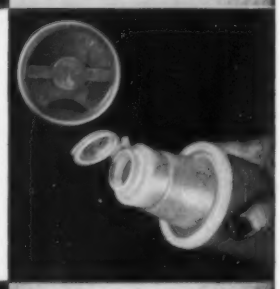
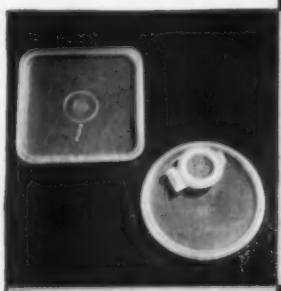


NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Per Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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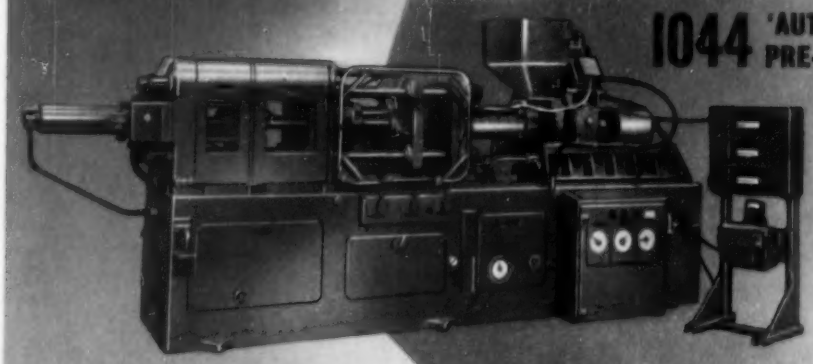
Address All Communications To: Dept. M-7

INJECTION

1044 'AUTOPLAS' PRE-PLASTICISER



This machine incorporates the famous twin-screw pre-plasticiser. Produces large mouldings up to 44 cubic inches of material (32 ounces of Cellulose Acetate). Temperature is controlled automatically by pyrometer.

The 2088 'Autoplas' pre-plasticiser, capable of moulding 88 cubic inches of plasticised material, is also available.

Literature illustrating full range of machines is available on request.

EXTRUSION

RC65 TWIN-SCREW EXTRUDER

Suitable for the production of lighter tubes and sections in thermoplastic materials. This machine will produce outputs of up to 75 lb. per hour dependent on the type of material and die construction. Supplied with standard Control Cabinets. A larger model, the RC100 with outputs up to 135 lb. per hour, is also available.

RH Windsor LTD

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BASF

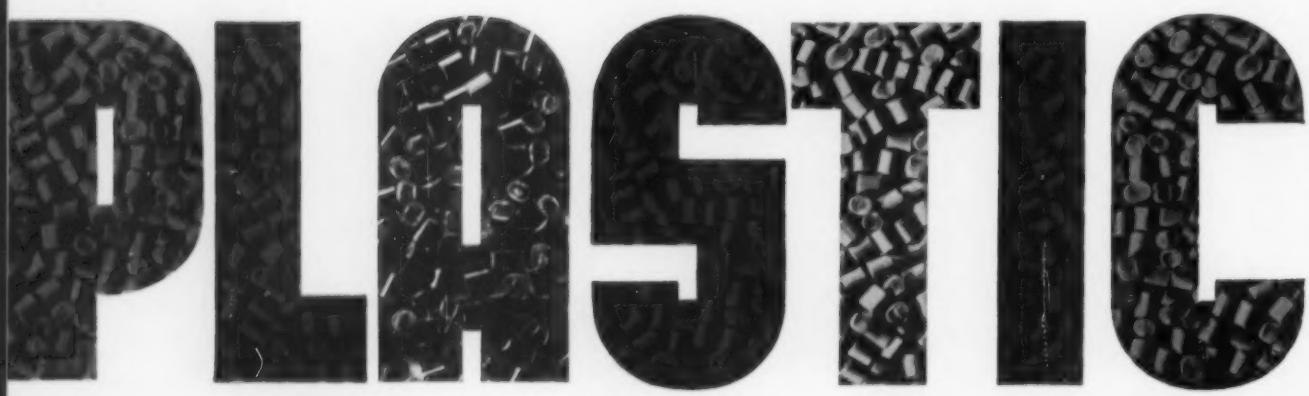
We supply plastics and technical service

Badische Anilin- & Soda-Fabrik AG., one of the largest plants of the chemical industry with over 36,000 employees, took up the development and production of plastics at a very early date. The industrial-scale production of Polystyrol – a pioneering achievement of BASF – began as early as 1930. Since that time they have developed many other plastic materials and techniques for their application, and today BASF with their extensive range of products are one of the world's largest suppliers of plastics.

BASF do not merely supply plastics, but they also place the extensive experience which they have gained in the application and processing of these products at the disposal of their customers. Experts in the plastics field are ready to advise and assist you in processing the materials correctly.

Make full use of this Technical Service to improve your production.

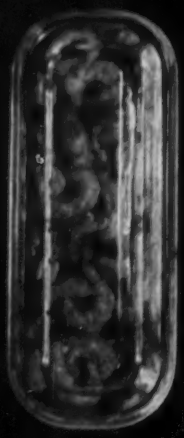
Literature describing the individual products will be gladly supplied on request.

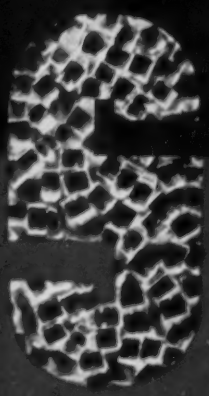


Badische Anilin & Soda-Fabrik A.G.

LUDWIGSHAFEN A·RHEIN

GERMANY





Polystyrol Polystyrene

STYROPOR® Micro-porous polystyrene

PVC (Polyvinyl Chloride)

LUPOLEN® H Polyethylene

ULTRAMID® Polyamide

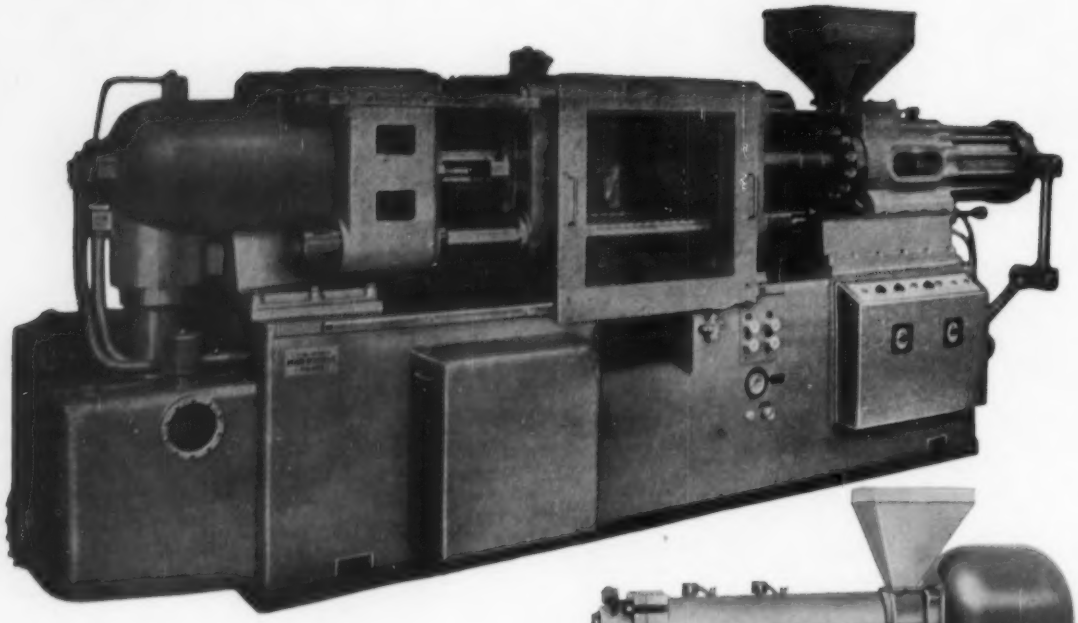
PALATAL® P Unsaturated polyester resin

Dispersions and
Solutions of Plastics

Plasticisers

OPPANOL® B Polyisobutylene

Base Materials for
Synthetic Fibres



These machines mean BUSINESS--for you

Inside each of these smoothly-finished housings is an efficient plastics machine, built to deliver long and profitable service. These are just a few in the extensive line of extruders, injection presses and vacuum formers built by Negri Bossi, a great name in plastics processing equipment.

INJECTION PRESSES—Negri Bossi injection presses, like the NB 360/520 shown here, can be set up almost anywhere because they get their operating pressures from a built-in oil-hydraulic drive that needs only electricity to operate. The new-design electrical system makes service and operation simplicity itself. Service of the cylinder, screw, nozzle and heaters is also simple; they can be removed as a unit by just one person. The operator is protected by an automatic device that prevents operation when the safety gate is open. Automation is a built-in feature of Negri Bossi presses; simply by shifting a lever, the operator can choose semi-automatic or fully-automatic cycling.

EXTRUDERS—Negri Bossi single screw extruders are available in models with 30mm, 45mm, and 60mm screw diameters (Types T/30, T/45 and T/60). Screws are made in a wide variety of designs out of a special chrome-hardened steel. Among the types of die heads available are those for making tubing and profiles, for coating wire and for blowing tubular sheeting. Ball bearings are used throughout the extruders at all points of friction. A built-in cooling system circulates water through the entire machine.

Negri Bossi also makes a full line of extruder take-off equipment.

VACUUM FORMERS—Here is something *really* sensational! Negri Bossi introduces vacuum formers with patented movable, variable infra-red heaters that concentrate heat where it is most needed, assuring constant cross-sections throughout formed pieces and permitting extremely deep draws. Negri Bossi also manufactures a low-cost model for laboratory and test-run use, and a high-output machine with two 25⅝" by 35⅜" stations.

Write for detailed information on machinery made by Negri Bossi, one of the world's largest manufacturers of plastics processing equipment.

Sole distributors in the U. S. A. **ACME MACHINERY & MANUFACTURING CO., INC.**
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New York Office: 2315 Broadway

NB&C

NEGRI BOSSI & CO, Milano *(Italy)*

Corso Magenta, 44 — Cable address: "Gianimar"

HEAT V LIGHT

HARSHAW VINYL STABILIZERS

for the vinyl plastic and coating industries

Important additives for processing and stabilizing clear and opaque vinyls—

CALENDERED FILMS AND SHEETS • EXTRUSIONS
RIGIDS AND FLEXIBLE
PLASTISOLS • ORGANOSOLS • COATINGS

CADMIUM 2-V-4

Leading heat and light stabilizer for clear or opaque stock, an organic liquid complex containing no disadvantageous soapy component. Unequalled for stabilizing against effects of sunlight or outdoor aging.

BARIUM-CADMIUM 128-V-5

Leading combination of coprecipitated laurates for outstanding performance, where lubricating advantages are required. Generally 30% more effective than common barium-cadmium laurates.

Best effects are attained for particular requirements by combining 2-V-4 or 128-V-5 in a stabilizing system with one or more of the following three stabilizers.

BARIUM 1-V-4

Compatible barium compound, minimum effect on viscosity. Permits processing at higher temperatures.

ORGANIC 8-V-1

Chelating agent, more than two times as effective as common organic phosphites. Inactivates harmful by-products to boost stability. Contributes to top clarity.

ORGANIC 7-V-2

Epoxy assistant, highly effective HCl scrubbing agent, undiluted. Will extend stability for longer processing periods.

CADMIUM 28-V-2

For rigids, opaque to translucent. Stabilizes unplasticized resin efficiently and economically, with minimum effect on physical properties of product.

Stabilizing Systems developed for Harshaw Customers, for special processing and finished product properties, may contain one of the following stabilizers.

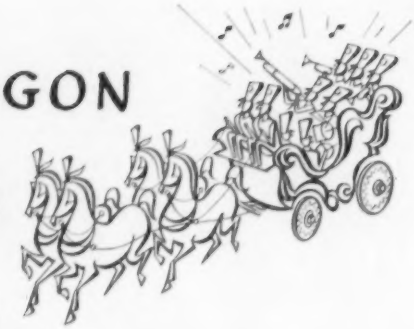
ZINC 9-V-1: Organic liquid complex containing no disadvantageous soapy component used in selected formulations.
CADMIUM 2-V-7: For modified solutions and organosols.
CADMIUM 24-V-1: Organic liquid complex for highest attainable clarity, used principally with dispersion resins.
CADMIUM 2-V-400: Modified 2-V-4.
CADMIUM 2-V-8: Selected laurate, used principally with low fusing resins.
BA-CD 12-V-5: Coprecipitated laurate.
CADMIUM 22-V-1: For rigid, clear and opaque stocks.
ORGANIC 7-V-1: Epoxy assistant.
ORGANIC 7-V-4: Epoxy assistant, for rigids.
BARIUM 1-V-3: Dispersible stearate, to contribute lubricity with barium effects.
BARIUM 1-V-6: For asbestos filled tile.
BARIUM 1-V-7: Liquid, for modified plastisols and organosols.
CALCIUM 5-V-1: Dispersible stearate, to contribute with calcium effects.
CALCIUM 5-V-22: Dispersible, low melting stearate to reduce internal friction.
ORGANIC 8-V-100: Modified 8-V-1.

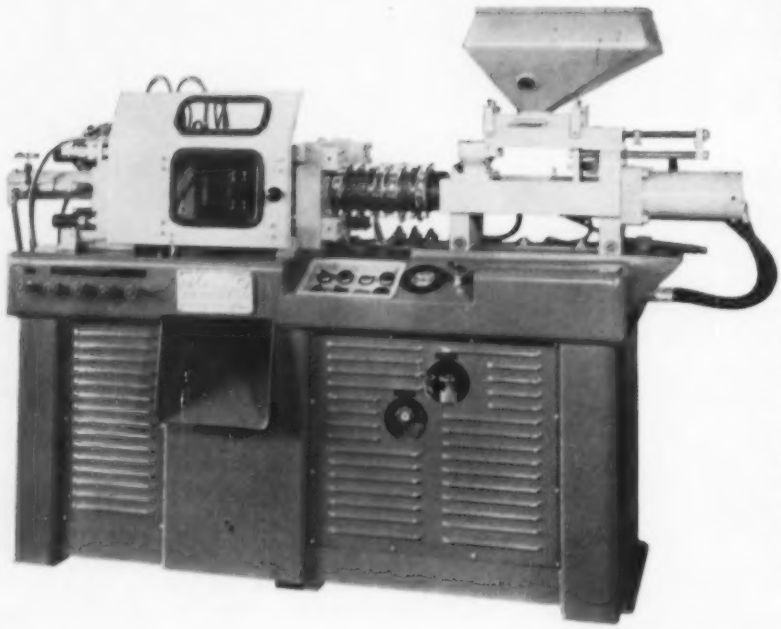
Write for a Vinyl Stabilizer Check List that you may use to detail as much as possible your particular requirements.

A practical stabilizing system will be suggested promptly, based on our experience with the various Vinyl Polymers and Copolymers and with the different Plasticizers, for your processing and product end-use requirements.

THE HARSHAW CHEMICAL CO.
CLEVELAND 6, OHIO

GET ON THE BANDWAGON with MOSLO HIGH-SPEED *Automatic Injection* MOLDING MACHINES





Molders say that long runs are now short runs with a Moslo Model 74 Super 2-ounce injection molding machine.

This unique machine was especially designed and engineered for high-speed injection molding of small parts from single-cavity and multi-cavity molds.

The production rate of the Moslo machine is so great that one custom molder is now getting 4½ times the hourly unit production than previously obtained from a competitive machine.

Illustrated below are examples of parts from multi-cavity molds. The possibilities are infinite. We know that a demonstration of a Moslo machine will really convince you—so bring your molds to our shop and let us show you.

The Moslo line includes these models.

Model 74-7—Super 2 ounce with 7" mold stroke

Model 74-12—Super 2 ounce with 12" mold stroke

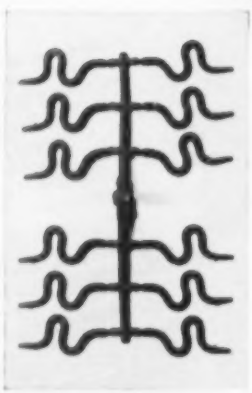
Model 75-8—High speed 3 ounce with 8" mold stroke

Model 75-15—High speed 3 ounce with 15" mold stroke

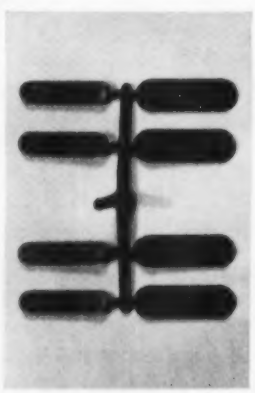
Model 76-8—Super 3 ounce with 8" mold stroke

Model 76-15—Super 3 ounce with 15" mold stroke
Famous Duplimatic for cord plug and insert work

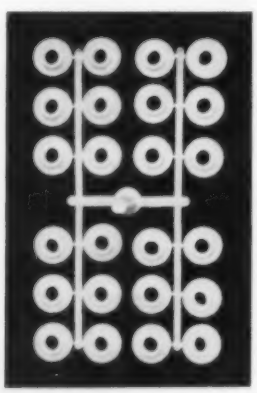
SALES REPRESENTATIVES NEEDED IN SOME AREAS



Vinyl Novelty Parts*
Molded from 27 grams of vinyl at 345 shots per hour.



Nylon Parts*
Molded from 25 grams of Nylon 210 shots per hour.



Nylon Bushings*
Molded from 42 grams of Nylon at 255 shots per hour.

***Molded on Moslo Model 74-7.**

MOSLO MACHINERY COMPANY
2437 PROSPECT AVENUE • CLEVELAND 15, OHIO

Vinyl compounders –

you benefit by specifying plasticizers made from

Indoil OXO ALCOHOLS

Here's how – You sell finished product by volume rather than by weight. You get the most volume at lowest cost by buying plasticizers on the basis of volume of finished product, not weight of finished product. At equal cost per pound Oxo Alcohol plasticizers such as DIOP and DDP are cheaper to use. Here is a comparison:

	DOP	DIOP	DDP
Density 20/4	0.983	0.983	0.963
EMC* at 1,600 psi	50.3	51.4	53.7

**Equivalent Modulus Concentration (phr)*

INDOIL plastics evaluation laboratory checks quality of INDOIL Alcohols by testing finished product. Here operator measures elongation of plasticized vinyl strip to determine Equivalent Modulus Concentration of plasticizer.

No need to reformulate—Compounders plasticizing with DOP need not refigure formulations in order to use DIOP or DDP. They can be modified by using this table:

Ratio $\frac{\text{Plasticizer phr}}{\text{DOP phr}}$	100% Elong. at 1,600 psi	100% Elong. at 900 psi
DOP	1.000	1.000
DIOP	1.022	1.019
DDP	1.068	1.086

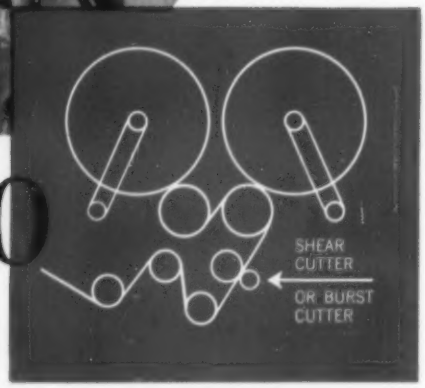
Contact your supplier – Ask your plasticizer manufacturer for samples of DIOP, DDP and other esters made with INDOIL Oxo Alcohols. INDOIL Chemical Company does not manufacture esters.

Information – Send for INDOIL Plasticizers from Oxo Alcohol Bulletins.

INDOIL® CHEMICAL PRODUCTS

INDOIL CHEMICAL COMPANY, 910 South Michigan Avenue, Chicago 80, Illinois

Can you meet the big demand for new FOIL wraps?



YES ... with the new 500

The new Camachine 500 is ideally suited for slitting and winding hard and soft aluminum foil, or foils laminated to paper or plastics. The sensitivity and accuracy of both the unwind and rewind controls make it possible to produce top quality, narrow width rolls up to 20" in diameter at speeds up to 2000 feet per minute.*

Here, for the wind-up end of your production line, is a machine that will protect profits on your entire plant operation. The 500 is easy to operate, exceptionally fast, and has earned a reputation for dependable, top quality production. Call, or write to Cameron for technical information.

The 500 is available in other models equipped, as shown in the above threading diagram, with individual rewind drums and individual rewind drives. This arrangement permits flexibility when separating two ply foil at high speeds and gives complete assurance of perfect rolls. 36" diameter rewind capacity is available in heavier models for both the separating operation and for single ply webs.

*Speed depends on characteristics of material, strip width and roll diameter.

AA-317A

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SEILON® S-3

SEILON S-3 is a single material of uniform molecular structure—tough thermoplastic sheet for vacuum forming which has an excellent balance of properties.

High impact strength over wide temperature range.
High heat distortion temperature.
Resistant to chemicals, oils and many solvents.

Applications: Cases of all types, tote boxes, trays, business machine covers, toys, automotive and airplane interiors, etc.

Available in: Calendered Rolls and Sheets
Press Laminated Sheets
Extruded Sheets

Look at these Test Comparisons!

	ASTM TEST#	SEILON S-3	COMPETITIVE MATERIAL
Specific Gravity		1.01	1.12
Tensile Strength psi	D638-52T	4500	3500
Elongation %	D638-52T	100	50
Modulus of Elasticity/Tension	D638-52T	196000	185,000
Compressive Strength psi	D695-52T	5100	5900
Flexural Strength psi	D790-49T	6800	6000
Heat Distortion Temp. °F	D648-45T	183	170
Impact Strength—Charpy at 70°F	D256-43T	6.43	8.0
Izod (notched) at 70°F	D256-47T	4.8	—
at 32°F	D758-48	3.5	—
at – 40°F	D758-48	1.6	—
Izod (unnotched) at 73°F	D758-48	48.0	—
at – 40°F		36.0	—
Brittleness Temp. °F	D746-44T	–45°	—
Hardness (Rockwell)	D785-51	"R"85	"R"75

Seiberling Plastics Division is adaptable to customers' requests—and we will welcome the opportunity to consult with you on individual specifications of properties, gauges, colors and finishes for your products.

Plastics Division

SEIBERLING RUBBER COMPANY
NEWCOMERSTOWN, OHIO • PHONE 8-8304

"Our NRM Thermoplastics EXTRUDERS

ARE HIGHLY PRODUCTIVE, EASY TO MAINTAIN AND BEST FOR CLOSE TOLERANCE-EXTRUSION..."

says Colorite Plastics of New Jersey, Inc.

Here's a company whose rapidly growing plastics extruding operations required five plant expansions in less than eight years . . . Their two divisions specialize in custom plastic extrusions, and garden hose produced for sale under their own label, as well as under the labels of many other companies. In discussing the part NRM Extruders are playing in the amazing growth of Colorite, J. R. Besserman added these comments to his above statement:

"We know the dimensionally accurate, high quality extrusions produced by our NRM Extruders have a lot to do with the trade success of our products. Their operating economy plays a big part in our profit picture, too. That's why we now have NRM Extruders exclusively."

If you extrude thermoplastics in any form or quantity, write us for details on the NRM *full* line of Extruders and Equipment. See for yourself why so many successful plastics processors like Colorite, go NRM *exclusively*. Patented "Balanced Heat Control," 20:1 Le/D ratio cylinders and quick-opening die-gates are only a few of the many NRM advanced design features that lead to greater profit on plastics extrusion. Write for more information today.

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'Perspex' for signs—a good book in any language

Not only does I.C.I. produce the widest range of plastics materials in the world—they also produce the widest range of technical literature. Whatever your plastics problem, you may well find the answer in these booklets, of which one of the latest, "'Perspex' For Signs", is illustrated here.

It will pay you to keep up to date with I.C.I. developments in plastics materials, published regularly in their literature.

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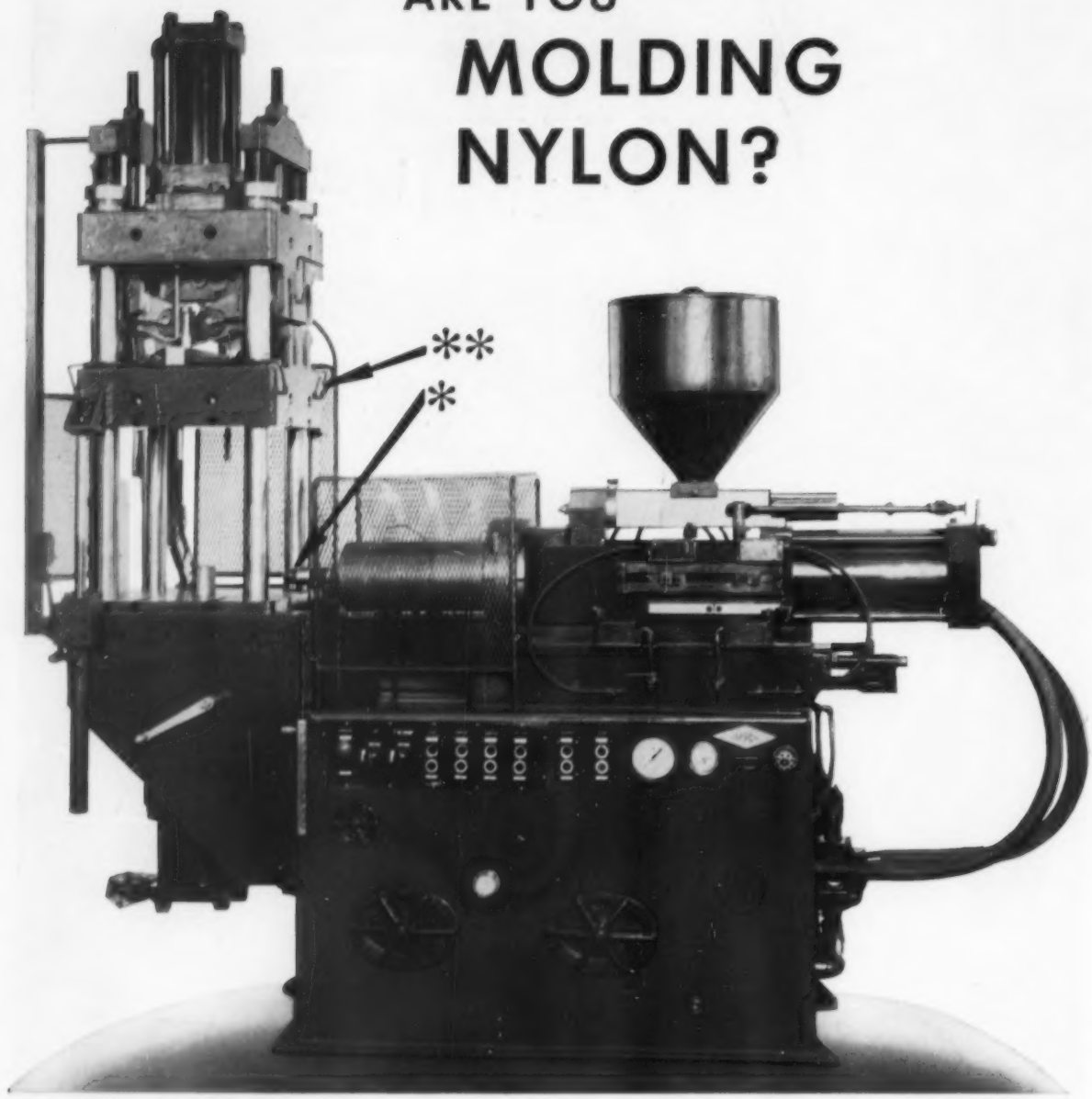
ARE YOU MOLDING NYLON?



IMPCO VA4-175-19 — 4-6 OUNCES

SPECIFICATIONS

Injection Capacity	4-6 oz.
Injection Pressure (Plunger)	21,750 p.s.i.
Plasticizing Capacity (Polystyrene)	75 lbs./hr.
Clamp Pressure (Toggle)	175 tons
Clamp Stroke	8"
Die Thickness	Max-14" Min-8"
Machine Cycle (Dry Run)	7/Min.
Auxiliary Bottom Ram	19 Tons
Dimensions	Length-102", Height-112", Width-60"
Weight	Approx.-9000 Lbs.

*No drool problem with this easily controlled check valve type nozzle.

**Vertical type press-ideal for insert molding.

If you are a nylon molder, you must investigate this Impco machine!

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the state of the union is excellent

Injection-molded CYCOLAC parts have exceptionally strong weld lines

THE PERFECT RESIN
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THAT DEMANDS

HIGH IMPACT STRENGTH
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The excellent knitting properties of CYCOLAC reduce stress failures around inserts and along flow lines. Especially adaptable for producing high strength pipe fittings, frames, rings, and open-face parts. High impact-resistance, good dimensional stability and high gloss.

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Division of BORG-WARNER
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Specially designed long cylinder assures quick and uniform melting; the cylinder can be easily replaced.

Hydraulic clamping system eliminates troublesome staynut adjustment.

U.S. Standards are adopted on machine parts, European are also available if requested.

Either Meiki hydraulic system or Oilgear's can be fitted at your option.

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Fully Hydraulic
Fully Automatic

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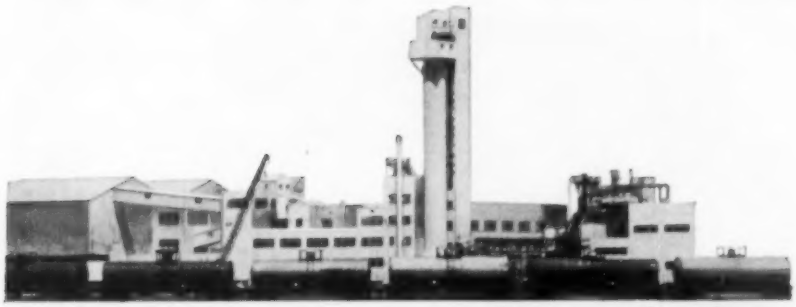
your Two best sources for UREA



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...and

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Allied's Nitrogen Division has 2 urea plants – one at South Point, Ohio and one at Omaha, Nebraska. When considering your source of UREA supply, Allied tops the list with its multi-plant production. Quality? Very high. Delivery? Fast – no matter where you are, thanks to widely separated producing locations. Carlots and trucklots from the plants. LCL from warehouse stocks in Passaic, N. J.; Chicago, Ill.; Providence, R. I.; East St. Louis, Ill.; and Charlotte, N. C. All shipments in easy-to-use, 100 lb. moistureproof multiwall paper bags.

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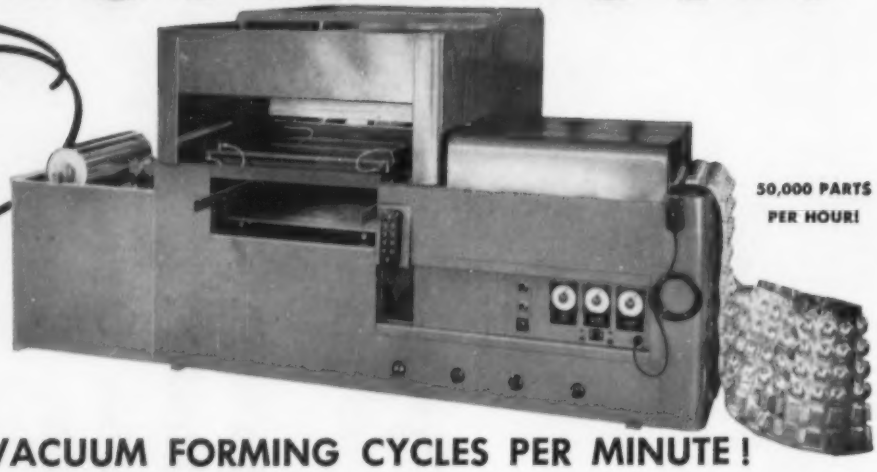
ROLL-VAC 22

COMPLETELY AUTOMATIC ROLL-FEED



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3 FULL VACUUM FORMING CYCLES PER MINUTE!

Introducing the new ROLL-VAC-22, an all purpose drape and vacuum forming machine, capable of 3-4 complete forming cycles per minute. The continuous roll-feed uses standard rolls (up to 22" wide) of Acetate, Butyrate, Vinyl, Polystyrene, and others. All of these outstanding Auto-Vac developments, proven in the standard machines, are built into the new ROLL-VAC-22 – plus complete automation. No operator is needed once the machine is set up and started. Die-cutting, filling or packaging operation can be synchronized into a continuous production line.

Where more versatility is required—where complex or larger shapes are to be formed—Auto-Vac vacuum forming machines are the obvious choice. They are the most advanced machines available.

Exclusive features include—automatic high-speed cooling for faster cycling • fully adjustable clamping frame, available with adjustable temperature control • lowest consumption uniform Hi-temp Calrod heater unit • heavy duty synchronized toggle action drape mechanism • adjustable drape frame height.

Auto-Vac machines are delivered fully equipped, complete units, ready to go to work. To help you establish and maintain the highest level of production, Auto-Vac will train your personnel at its own plant.

Pioneers!

Pioneers in the development and manufacture of the most advanced vacuum forming machines in the world.

Write today for further information and BULLETIN 55, which gives full information about Auto-Vac's standard drape and vacuum forming machines.

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in vinyl garden hose . . .

Stabilizer Mark M or Mark M–Mark PL combination

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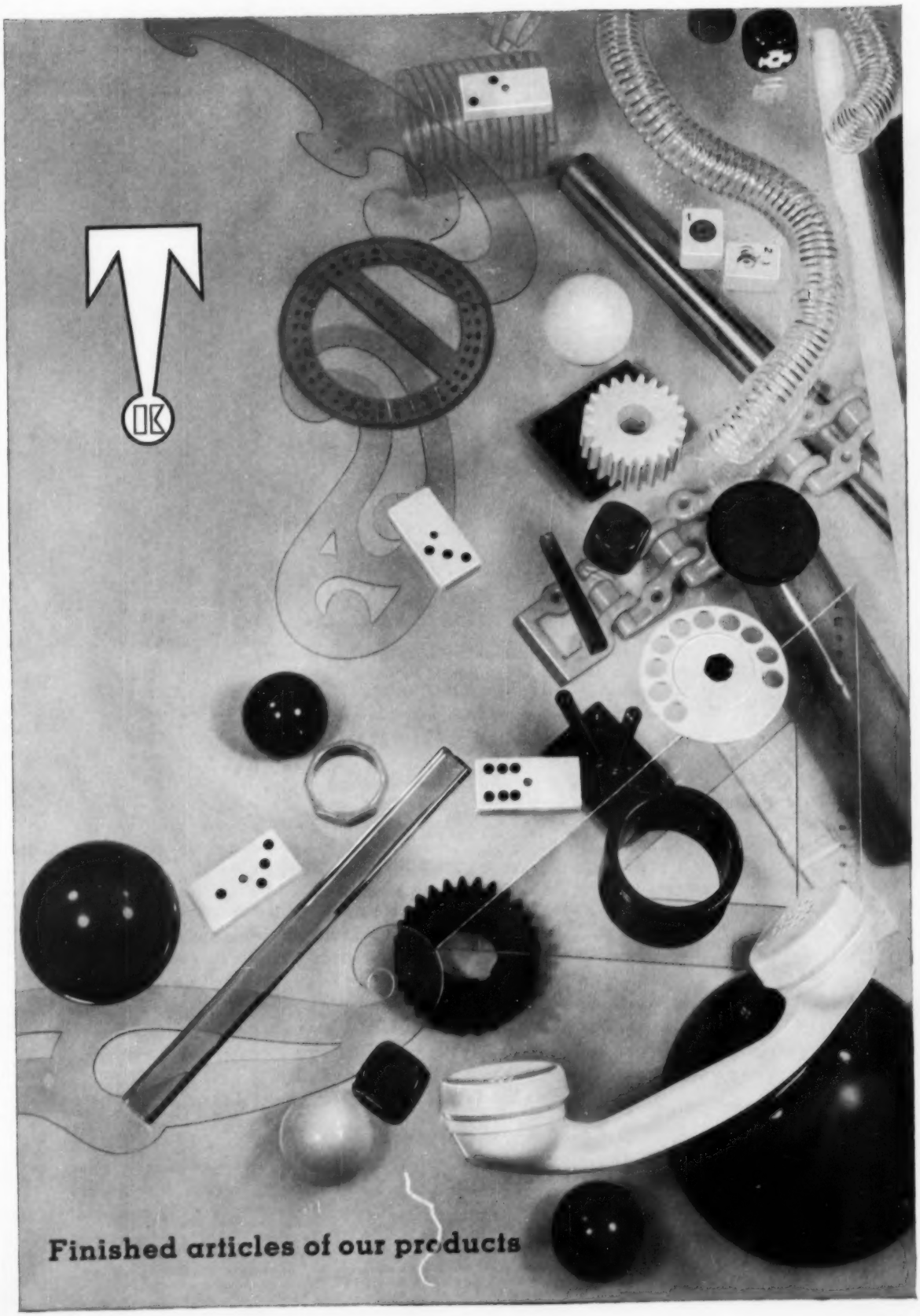
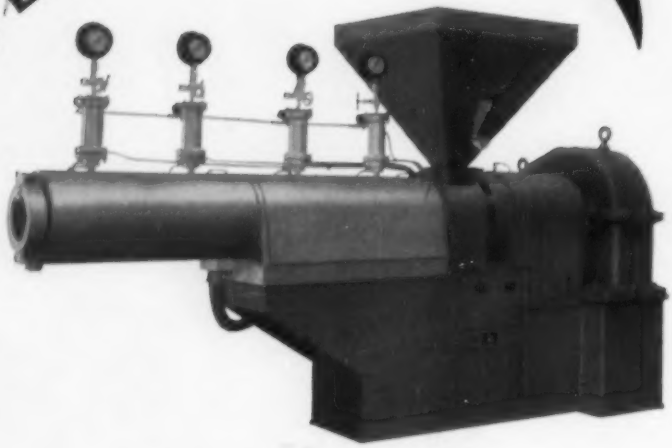

Finished articles of our products

Egan EXTRUDERS



"WILLERT VAPOR PRESSURE COOLING"*

This *Egan* designed system automatically eliminates problems of overheating due to excessive frictional heat. It is completely automatic—No moving parts—No need for operator to determine whether cooling should be "on" or "off"

*Patent applied for

another Egan first

Standard *Egan* extruders for thermoplastics, in production use throughout the free world, have been designed for maximum flexibility and incorporate all the features important in extruder design.

Available with or without "Willert Vapor Pressure Cooling"* in all sizes from 2" to 8" • Screw lengths 16:1 or 20:1 • Hard corrosion resistant liners • Heavy duty thrust and radial bearings, force feed lubrication • Completely prewired temperature control cabinet • Screw speed tachometer • Precision ground screws Large feed hoppers with sight glass and cut-off slide Complete installations for film, sheet, pipe or shapes.

*Patent applied for

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Whatever your industry or plastic part requirements, American's your answer. One of the nation's oldest and largest manufacturers of plastics, American offers facilities for injection, compression, extrusion, double-shot injection molding and low pressure and vacuum assisted molding. American's ultra-modern equipment can mold most types of plastics, including cellulose acetate and butyrate, polystyrene, acrylics, reinforced fibreglass and copolymers. American's giant plant can handle every stage of manufacture from design to mass production. Regardless of whether your plastic problem is clear-cut or complex . . . regardless whether your needs are small or large, call upon American for the economical, quality answer. Write direct for further information today. Address Dept. AAA.

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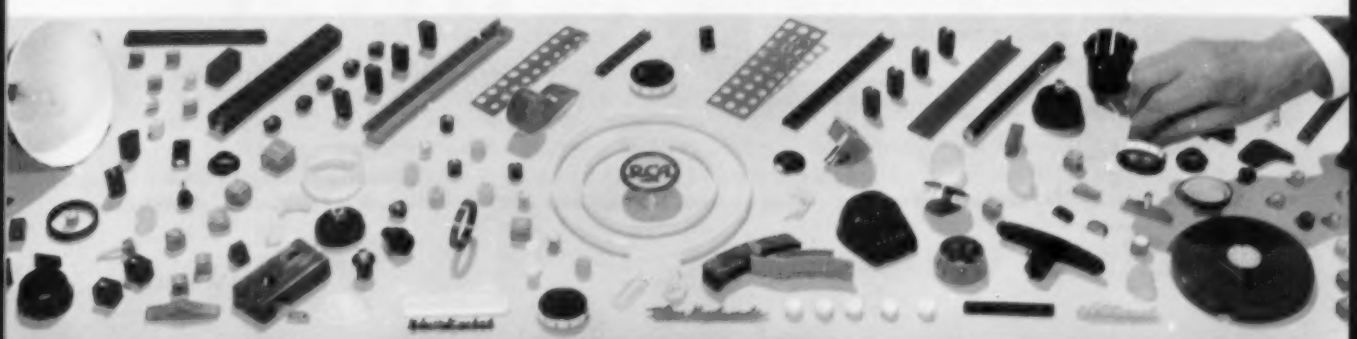
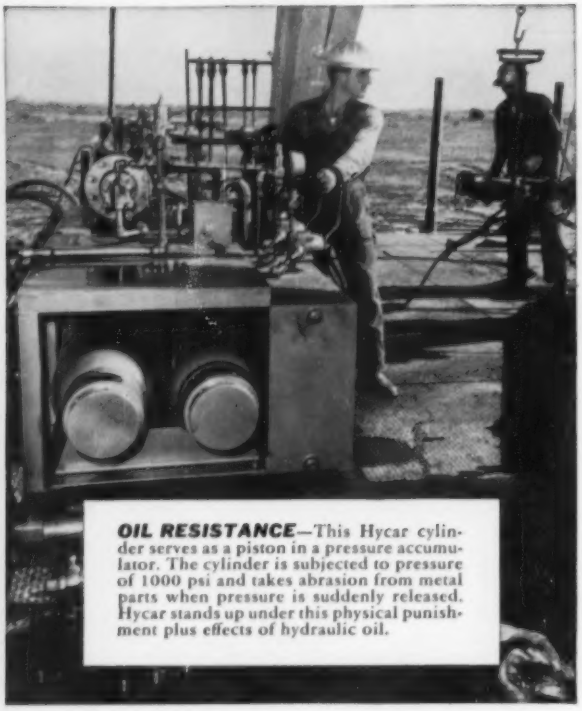
Plastics Production Partner of America's Most Progressive Manufacturers



News about

B.F.Goodrich Chemical *raw materials*

RESILIENCE—A Hycar blanket fits around this cylinder that presses paper down on a printing press surface. The Hycar must "give" under pressure, yet snap back through millions of impressions, retaining original thickness within a thousandth of an inch.



OIL RESISTANCE—This Hycar cylinder serves as a piston in a pressure accumulator. The cylinder is subjected to pressure of 1000 psi and takes abrasion from metal parts when pressure is suddenly released. Hycar stands up under this physical punishment plus effects of hydraulic oil.

LONG WEAR—These roller skate wheels prove Hycar's exceptional wearing qualities. Wheels maintain perfect balance and roundness, keep a good grip on the surface. Hycar is easily molded for products like this, retains high dimensional stability.

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MODERN PLASTICS
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The cause and cure of unrealistic quotes on plastics parts

Many purchasing agents and design engineers, especially in the home appliance, electronics, and automotive fields, will argue at length that: a) it is more difficult to buy injection molded plastics parts than those made of other materials and b) it is probably harder to buy such plastics parts than to sell them.

Their basic reason rests, of course, in the difficulty of securing a reasonable quotation pattern when projected jobs are put out for bids.

On pages 82 and 83 will be found several illustrations of molded refrigerator parts with the number of bidders and percentage of price fluctuation from low to high bids given in each case.

These variations ran all the way from 10 to 60 percent. Yet in the metal field the same purchaser found, through several years of experience, that bids from different companies in unfinished stampings would vary only about 1% from low to high, in finished stampings a maximum of 15%, in hardware and die castings 4%, in shelving and wire goods 5%, and in rolled sections and metal trim 8 percent. And surprisingly, it was found that the quotation range from low to high on large vacuum formed parts is generally only between 5 and 10 percent.

Why should there be such tremendous variations in quotations on molded parts? The causes are many and are bound up in the diverse factors involved in product design and engineering; in mold design and manufacturing; in material selection in relation to property, price, and cycle; in the type and size of machine to be used for the job; and in the kind of cost distribution used by the bidding molder.

Unrealistic and inconsistent estimating is not entirely to be blamed on the molder. There are four sources of either commercial peace and harmony or grief and irritation—the molder's customer, the molder's estimator, the accountant, and the mold maker. Note that the material maker is not generally involved, because his presentation of weight, property, and price facts is generally quite firm and simple to use in estimating.

In this article the divergent viewpoints of the four parties chiefly concerned with the problem

This article was prepared from a study of four papers presented at the recent Midwest Plastics Conference of S.P.I. The cast, in order of their appearance, is as follows:

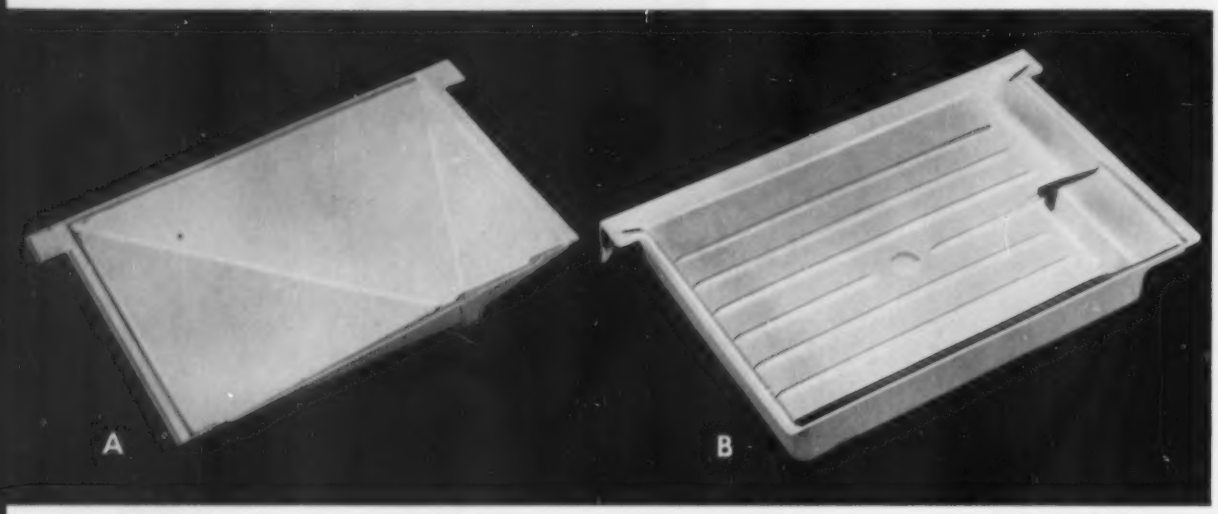
The Molder's Customer, Chas. T. Dyson, Director of Purchases, Whirlpool-Seeger Corp., Evansville, Ind.

The Custom Molder, Ned Porte, Plastics Div., General American Transportation Corp., Chicago, Ill.

The Auditor, William H. Nussbaum, C.P.A., Rutherford, N. J.

The Mold Maker, John A. Kavanagh, Vice Pres., Standard Tool Co., Leominster, Mass.

One refrigerator maker, asking for bids from molders on



A) Chiller tray
6 bids invited
High bid **35%** over low

B) Humidorator
6 bids invited
High bid **25%** over low

C) Breaker trim
5 bids invited
High bid **10%** over low

D) Butter tray
5 bids invited
High bid **60%** over low

of injection molding estimates will be presented in turn, with a view to exposing the causes and finding possible cures.

The customer's opinion

1) The purchasing agent of an end-user company, together with his design engineer, finds some lack of knowledge on the part of the molder as to the *requirements* on a finished part. This could be the customer's fault through failure to fully advise the molder. There might be insufficient engineering liaison between the two. Misunderstanding could result from verbal instruction or relay of instruction. The only answer is for no party to assume anything, for questions to be asked when doubts arise, for the engineers of both molder and customer to work together from the beginning of the part and product design stage through to the finished job, and for everything to be put in writing so that negotiations can be traced back if necessary.

2) There are less complaints about *variance in mold costs* than there are about variance in piece price quotations. There are occasional cases of over-or-under-design of mold equipment as to type required and number of cavities. The answer here is for the customer's annual requirements and his weekly and daily rates of production to be spelled out in writing. Quotations from molders should declare the number of cavities on which the bid is being made so that the buyer can compare related costs between vendors. If possible, molders should quote on several different cavity molds so the buyer may make his own selection.

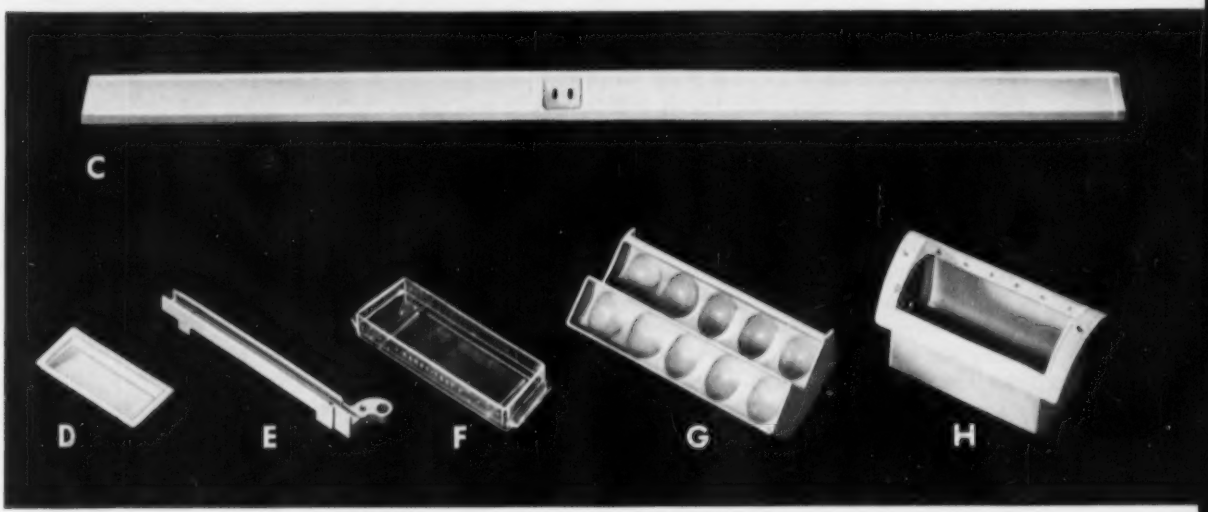
3) Each molding company is somewhat different in respect to distribution of *indirect costs* over the various cost centers. The proper relationship of indirect to direct costs must be determined and maintained so that each bid can stand on its own feet, which should result in a sincere and consistent price pattern.

4) *Packaging costs* are a growing and vital factor in total bids on customer work. This is a matter which the molder's engineers must study and on which they must inform the estimators.

5) There is an almost absurd variation in estimates of *quantities of raw material* required for a given part. There is no excuse for this, since there can be only one true weight on any item in any material, and that is a matter of straight mathematical calculation.

6) The *proper machine* must be selected by the molder for the job. No molder will find it wise in the end to bid by figuring an attempt to run a large part on an inadequate machine in order to keep a machine busy or save money.

eight parts for one model, found these price variations:



E) Chiller slide
5 bids invited
High bid **30%** over low

F) Utility tray
7 bids invited
High bid **50%** over low

G) Egg rack
8 bids invited
High bid **25%** over low

H) Butter compartment
7 bids invited
High bid **30%** over low

7) There is a complaint that some firms change their *pricing methods* from time to time and even use one cost structure for a favored customer, another for customers not so favored. Inadequate control of scrap factors and "play-it-safe" when figuring scrap also results in high bids.

8) No customer has confidence in a molder's salesman who quotes high, then asks for and is given an opportunity to *recheck his costs*—and then calmly makes a drastic reduction in price. There is always a suspicion that service will be less than satisfactory.

The molder speaks

Estimating is no easy job, but it can become quite accurate and can be closely checked *if the method of estimating is identical to the method of cost finding.* There is no place today for the tentative estimate, the quick estimate, the qualified estimate. A second basic concept is that the estimate, when complete, becomes the standard for production.

Factory cost is comprised of a total of the following factors: direct material cost, direct labor cost, indirect labor cost (usually a predetermined percentage added to direct labor cost), factory overhead, press hour rate. Everyone who has been in business for any length of time knows what each of these factors represent; there are plenty of management textbooks covering the subject. However, an estimate is not complete until two management factors are added, one covering sales and administration and the other mark-up or profit. In essence, these two items can represent one of the major differences in the finalized quotation to a customer.

On the part of molding company management, it is important that the auditor, whose job it is to collect cost data, should work with management in determining overhead, press hour rates, and rates of cost liquidation. Then the estimator and the engineer come into the picture—the estimator to define the more direct plant costs and to define the method of calculating, the engineer to contribute ideas for improving methods and lowering costs.

Normally a custom molder (assuming that credit is no problem) deals with three types of customers: a) the large end-user manufacturer, such as an appliance maker or an automobile manufacturer, who has a design department and an adequate engineering department, a knowledge of molds for plastics, and a knowledge of time factors involved; b) the customer who has had one or two parts molded in plastics and some smattering of knowledge of some plastics materials, but who is not completely

aware of what can or cannot be done in molding, who lacks an adequate design and engineering department, and is consequently amazed at the costs involved in mold-making and at the delivery time for molds; c) the prospective customer who has never had a part molded in plastics and whose staff has no idea of what is involved and consequently knows nothing about material conversion, material selection, basic design, or mold construction and use.

Regardless of the type of customer concerned, the custom molder of today and tomorrow must have sound engineering talent on staff, must have trained estimators, and must make use of his auditor's services. In the case of the sophisticated customer, this will make for closer liaison at every point in evolving a quotation; in the case of the customer who has played around a little with plastics, it will encourage confidence and make for cooperation; in the case of the customer new to plastics, it will place the molder in a position to give creative service so that there may be no misapplication and no misquoting.

Customers of all types are inclined to demand spot snap analyses of component requirements and costs. Custom molders' salesmen must remember that "haste makes waste." It is the molder who has to pay for overtime, so sufficient time must be allowed by the engineers and estimators to study the product and part plans. Another point of constant misunderstanding will be obviated if the engineering staff of the custom molder will keep up-to-date on the tool room capacity for new molds and the time-lag situation in mold making in the industry.

The better the engineering facilities of the plastics custom molder (and this item of expense should be *completely liquidated* by the auditor in the overhead expense) the better job he will do and the more consistent will be his quotations.

The auditor's comments

When one, two, or a group of men decide to go into the plastics molding business, a pot is filled with gold which represents the capital of the enterprise. Nobody except a customer will ever put a penny back into that pot. There is rent or the cost of real estate, the cost of presses, the cost of material, labor, taxes, insurance, administrative and engineering talent —all of which must be paid out of that pot.

But the "phantom" factors are the ones which, unobserved by complacement management, scoop out the gold faster than it can be replaced and added to by profits on business placed by customers. First, there is loss of material in storage and on the way to the press; second, there is the matter of rejects and scrap; third, there is the matter of down-time and connected with that, the matter of running a press at high capacity and storing parts for proportioned delivery to customers; fourth, it has been found that plastics custom-molding plants seldom run at better than 70% of capacity, so costing must be on the basis of covering 100% of amortization and overhead with 70% of revenue-producing work; fifth, there are a lot of efficiency losses resulting from fatigue, color changes, etc.; sixth, there are sometimes improper allocations of costs to centers whereby one overhead rate would be used for all size presses, which could result in plenty of orders for the larger presses and very few for the smaller presses; seventh, there is the point of necessary expansion without the addition of new capital—and everyone knows that short-term money costs more to borrow.

Unless *all* of the physical factors and *all* of the phantom factors are included in the price quoted to the customers, so that the customers will be putting back all the gold that has been taken out and more, the molder will come upon a day when he'll wonder where the yellow went!

There is a great variance in attitude between a salesman, usually on commission, and an engineer, on salary, in the development of estimates and quotations. The salesman is faced with a "fear factor" in a case where he is handed a quotation of, say, $70 on a given quantity for a given molding, and the customer states that a molding competitor has quoted $50. The salesman goes to management and management wonders whether engineering and estimating have made mistakes or whether the job should be taken at a predictable loss "just to keep the presses running."

Impossible competition is as well known in the plastics molding industry as in any other industry anywhere. This competition may come from a proprietary molder with seasonal lines and occasional down-time, who wants to fill up his presses and is willing to do so at only the cost of overhead, or it may come from a very small shop which doesn't have to face complicated overhead factors.

Custom molders can function efficiently and profit properly only by absolutely (*To page* 195)

Plastic-based recording tape is revolutionizing many forms of communications. It contributes to more accurate interviews, business efficiency, home entertainment . . . the list goes on and on. (Photo, Bell & Howell Co.)

Six billion feet in 1955!

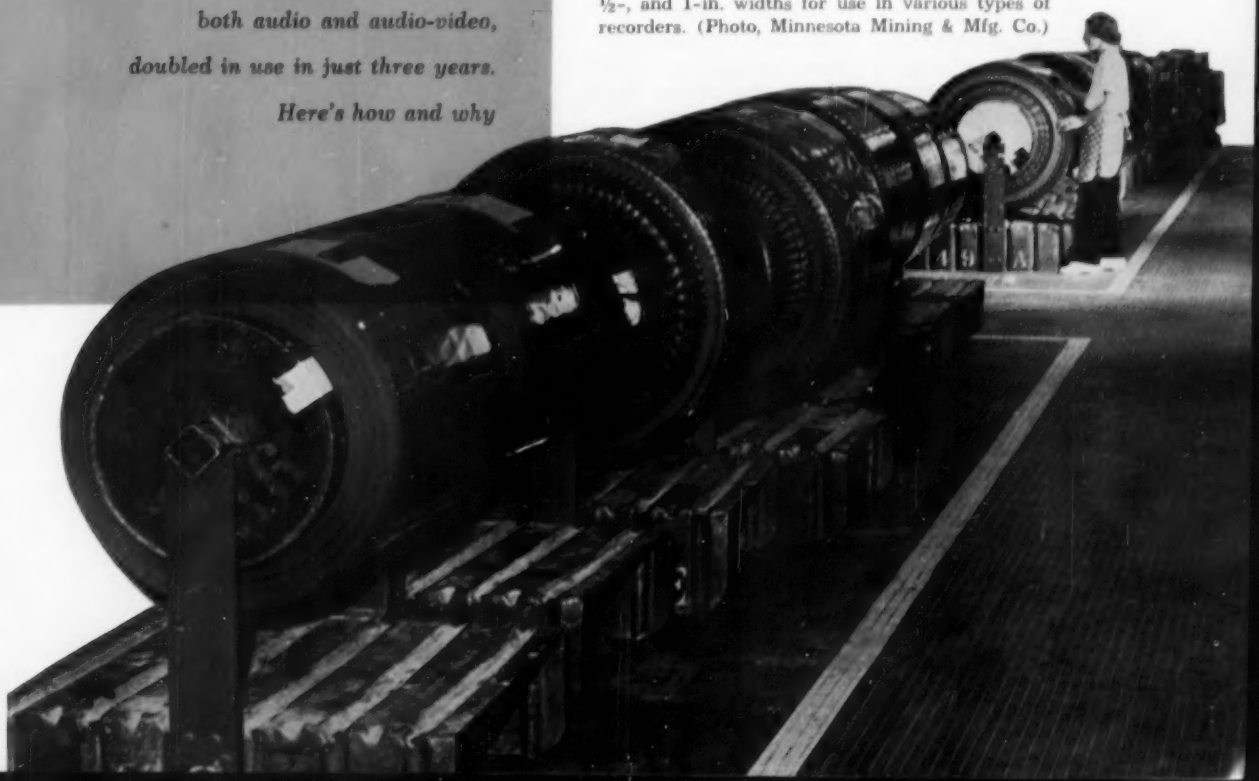
Coated acetate and polyester tapes for magnetic recording, both audio and audio-video, doubled in use in just three years. Here's how and why

A narrow strip of cellulose acetate or polyester film approximately 1 mil in thickness, coated with a microscopically thin layer of iron oxide and a vinyl resin binder, has paved the way to one of the most exciting and significant commercial developments in sound recording in recent years. Magnetic recording, practically unknown prior to World War II outside scientific circles, has now blossomed into a lusty new industry rated at more than $100 million annually. Its rapid growth can be attributed largely to the successful development of plastic-based tapes.

The rapidly increasing use of magnetic tape reflects not only the swift increase in the number of recorders being produced—an estimated 360,000 units of all kinds were made in 1955—but also the fact that the magnetic recording process is fast being adapted to many new types of applications. Radio broadcasting, motion pictures, home and commercial work, and numerous other scientific projects by no means exhaust the list of jobs now being handled with recording equipment. New and important applications are being developed with startling rapidity.

The volume of plastic tape utilized by magnetic recorders in their ever-increasing range of assignments has reached sizable proportions, and the end is by no means in sight. With well

Huge rolls of acetate film, 24 in. wide, have been coated with iron oxide and will be slit into ¼-, ½-, and 1-in. widths for use in various types of recorders. (Photo, Minnesota Mining & Mfg. Co.)



over a million tape recorders now in the hands of the U. S. public, for example, the potential market for prerecorded musical selections and other material can scarcely be ignored. Tape cartridges made from styrene, other plastics, or sheet metal, that eliminate threading the tape are now in production by American Molded Products Co.; Cousino, Inc.; Mohawk Business Machines Corp.; and others. Because of their convenience, these units are expected to increase greatly the popularity of tape-recorded music. Cartridge-type "message repeaters" are also being pushed for use wherever a sales message is to be repeated at the point-of-purchase; they are finding other uses for police traffic control, to give voice to advertising displays, etc.

According to the Magnetic Recording Industry Association, the volume of magnetic tape of all kinds produced during the past several years has increased as follows:

1952	2.593 billion ft.
1953	3.351 billion ft.
1954	5.366 billion ft.
1955	6.000 billion ft.

It is conservatively estimated that total retail value of all magnetic tape produced in 1955 was $8.1 million, as compared with $7.2 million in 1954.

Of the plastic tapes employed in magnetic recording, the major proportion—approximately 90%—are composed of cellulose acetate. Mylar polyester tape, a relative newcomer in the field, accounts for a small but rapidly growing share of the market. Although considerably more costly than cellulose acetate tape, the polyester variety offers superior tensile strength, greater tear resistance, and almost negligible elongation or shrinkage under extreme temperature and humidity changes. Thus it is particularly suitable for use in dictation recorders, endless-loop tape machines, and high speed industrial and scientific recorders.

Early post-war magnetic recording tapes showed a lack of uniform quality, making standardization of equipment and recording procedures difficult. In addition, their low output necessitated large amplifiers in the recorder, while poor response at short wave lengths required the tape to be driven at high speeds to maintain adequate frequency response.

Quality improved

These and related problems were attacked by Minnesota Mining and Mfg. Co. and various other firms interested in the field. Improved types of magnetic oxides, developed by Minnesota Mining, were an important factor in obtaining greater output and response character-

Pocket-size tape recorder uses cartridge-type reels, will record continuously for one full hour, runs on self-contained batteries. (Photo, Mohawk Business Machines Corp.)

Polyester-based magnetic recording tape is used in butt-spliced belt for dictating machine; recording is done on continuous spiral covering entire useful belt surface. (Photo, Comptometer Dictating Div., Felt & Tarrant)

istics. However, improved oxides are only one of the improvements incorporated in today's magnetic tapes, which are turned out in increasing quantities by such firms as 3M, Reeves Soundcraft Corp., Audio Devices, Inc., and Orradio Industries.

The key to the production of high-quality magnetic recording tapes was the development of methods for depositing a uniform coating of iron oxide on a plastic base of uniform gage. The thickness of the oxide coating must be kept within extremely narrow limits if the strength and quality of the reproduced sound is to be maintained.

As machine manufacturers began placing two or more magnetic tracks on the same tape, thereby increasing the available recording time, these factors became more and more important. If the uniformity of the oxide coating was relatively poor, numerous large particles ("nodules") existed which, when passed across the heads of a recorder, lifted the tape slightly from them, thus causing a signal drop-out. These clumps of agglomerated magnetic oxide formed as the tape was coated; particles as small as 0.0001 in. in size caused trouble.

Minnesota Mining, which accounts for more than half of all magnetic tape presently manufactured, approached the problems from two directions. One 3M team was assigned to reformulate the coating to improve its magnetic properties and eliminate factors which caused the oxide particles to agglomerate and form nodules. The second, concerned mainly with production, tackled such details as dust elimination, cleanliness in the processing areas, and filtration of the oxide dispersion to remove all particles above a certain size limit. After nearly a year of development, a new resin system was put into full-scale production.

Message-repeater cartridges hold enough polyester-base magnetic recording tape to run up to 4 min.; are used for either continuous repetitions of sales messages, traffic control instructions, etc., or can be actuated by electric-eye switches, floor treads, or other means. (Photo, Mohawk Business Machines Corp.)

Easily handled styrene cartridge for magnetic recording tape is inserted into recorder, ready for use without threading. (Photo, American Molded Products Co.)

Sources of tape base

Major suppliers of the cellulose acetate and polyester backing materials used in magnetic tape production include Celanese Corp., Du Pont, and the Cellulose Products Div., Eastman Kodak Co. There are no special specifications for the film, other than the fact that it must be of "sound-recording" quality. As supplied by the film manufacturers in roll form, all backing material is transparent; the color of the finished tape comes from the oxide coating.

Binders used in producing the tapes are usually vinyl or acrylate resins. In the coating process, moderate heat is applied to facilitate drying of the coating. In the manufacture of "Scotch" brand magnetic tapes, the coating is impregnated with silicone which, when the tape is in use, continually relubricates the surface.

In the production of magnetic tape, the basic cellulose acetate or polyester film material is handled in "jumbo" rolls—as wide as 24 in.—through the coating operation, then slit into the required widths and wound on reels. For conventional magnetic recorders, the tape is slit to a finished width of ¼ in. and wound on specially designed molded styrene reels of either 5- or 7-in. diameter. Other standard tape widths for commercial and scientific magnetic recording applications are ½ in., ¾ in. and 1 in.;

Easier threading for magnetic recording tape is provided by molded styrene reel in top photo. Tape is gripped firmly by notch in one side of real. In lower photo is a rugged reinforced plastics reel with the same threading feature, plus a smooth surface that can be labelled with pen, pencil, or crayon. (Photos, Minnesota Mining & Mfg. Co.)

tapes are also produced in various special widths, as required. For example, a 3-in. wide tape, supplied in 1000-ft. lengths on molded Cycolac reels, is used in 24-hr. monitoring of radio communications. Some types of magnetic recording equipment utilize a wide tape, butt-spliced to form a sleeve or belt, rather than linear tape; this arrangement offers certain advantages in the design of equipment, indexing of recorded material, etc.

Exacting requirements

The tight control which must be exercised in making high quality magnetic tape is indicated by Minnesota Mining's production of tape developed to meet the exacting requirements of the instrumentation and allied fields. In coating this tape, special "high-screen" filtration equipment eliminates all particles in the coating dispersion larger than about 5 microns. Every foot of the tape is monitored for signal uniformity and noise level as it is being produced, and elaborate precautions are taken to prevent contamination by dust and other foreign matter. Before the jumbo rolls are slit to finished tape widths, the quality control department inspects the tape for physical and magnetic properties. Only after passing these tests is the parent roll slit into finished tapes. As a further protective measure, reels of tape are sealed in polyethylene bags.

The caliper of the cellulose acetate film used in producing this tape is from 1.40 to 1.45 mils. The iron oxide coating applied to the film in the manufacturing process has a thickness of from 0.50 to 0.55 mil, producing a total finished thickness of from 1.90 to 2 mils. Like other 3M magnetic tapes, this type is subjected to a "dry lubrication" treatment with silicones, giving it a low coefficient of friction which increases tape life, reduces recording head wear, and guards against oxide rub-off.

This typical ¼-in. acetate-base magnetic tape has a breaking strength of 5.5 to 6 lb. and an ultimate elongation at break of 20 to 25 percent. A comparable polyester-base tape will withstand a 9-lb. pull, and has a tear strength approximately six times as great as acetate tape, and has less than one-tenth the elongation or shrinkage under extreme changes in temperature and humidity.

The introduction of Minnesota Mining's "Extra Play" magnetic tape marked the first time since the advent of dual-track recording that a major increase in recording and play-back time was possible without either decreasing tape speed or employing a longer length of tape. This was made possible through the development of an oxide coating only half as thick as standard coatings (but with equivalent magnetic properties), coupled with a thinner cellulose acetate backing. Because of the decreased thickness of the plastic film, half again as much of the thinner tape can be wound on a standard reel, giving a 50% increase in recording and play-back time for the same size reel. In some of the latest magnetic recording tapes, acetate or polyester film 1 mil or less in thickness is employed. Thin-backed tapes also tend to improve frequency response because they conform better to the shape of the recording head. Some manufacturers are now offering 0.5 mil-polyester-base tape.

Special acetate splicing tape

One of the most appealing and useful characteristics of plastic-base magnetic tape is the ease with which it may be cut and spliced without impairing the quality of the recording. Using cellulose acetate tape having a special

type of pressure-sensitive coating, splices may be easily made which are as strong as the tape itself and can be detected only by the most sensitive computer-type recorders. The special adhesive used on this tape will not ooze or slip under normal tension and will not gum-up the recording head of the machine.

As indicated earlier, one of the most important developments pointing to greatly increased activity in the magnetic recording field is the growing number of prerecorded tapes now being offered to the public. These tapes can be produced as multiple recordings made on a common-mandrel machine or by playing-back a master tape and feeding the electrical impulses simultaneously into multiple recording units. Operating at high speed, as many as 2400 hr. of recorded material can be duplicated in 8 hr. by the latter method. Loss of quality in tape duplicating is extremely small—smaller than in duplicating any other recording medium today, according to Paul W. Jansen, Magnetic Products Div., Minnesota Mining & Mfg. Co.

Even the complicated operations of machine tools are now being controlled by means of magnetic tapes. At North American Aviation, an automated "skin mill," controlled by means of a tape recording unit, produces intricately contoured jet aircraft stabilizers from 1½-in. thick aluminum slabs; the finished parts have a tolerance of only 0.001 inch. One type of portable tape recorder on the market—a pocket-sized unit—records for one full hour on a single cartridge of tape, weighs only 2¾ lb., and runs on self-contained batteries that provide 45 hr. or more of operation. In the handling of statistics by business machines, as many as a thousand bits of statistical data can be recorded on a single inch of magnetic tape.

Perhaps the most exciting new assignment on the magnetic recording horizon is audio-video tape for recording both pictures and sounds captured by the television camera. Machines have been developed which store on tape the electric signals generated by the TV camera. Through this far-reaching development, motion pictures in black and white or color can be produced quickly and economically without the need for photographic equipment.

Duplication of magnetic tape recordings is accomplished in two ways. At left is a common-mandrel duplicator on which several copies can be made simultaneously. At right is equipment in which a master tape is played back and the resulting electrical impulses feed to slave recorders. This machine duplicates at speeds up to eight times the normal playing time of the tapes. (Photos, Minnesota Mining & Mfg. Co.)

ITALY: engineering advance

*By Ing. Giovanni Moretti**

For the past several years Italian consumption of plastics has increased 25% or more per year. (See graph, p. 92.) Every indication is that this trend will be accelerated in the future. Italy's population is 48 million and 1955 per capita consumption was 3.3 pounds. With a constant improvement in living standards and with greater public confidence in plastics, this growth rate may well be even greater in the years ahead. Table I, p. 92, shows 1956 estimates compared with 1955 consumption.

Imports and exports

During 1955, Italian foreign trade in plastics was as follows, according to official statistics (estimated on figures for the first 11 months of the year):

Material	*Imports*	*Exports*
Styrenes, Acrylics, Vinyls, Polyethylenes, Fluorocarbons, Other polymers	*1000 lb.* 8330	*1000 lb.* 59,000
Cellulosics	7340	1550
Phenolics (molding and industrial resins)	880	400
Aminos (molding and industrial resins)	4450	930
Others	4450	2225
	25,460	64,105

The excess of exports over imports amounts to 38 million lb. for the plastics considered.

Synthetic resin producers

The more important synthetic resin producers are about 20 in number and the total production capacity of the plants is considerably greater than the needs of the present home market; at least 25% of the production must be sold abroad. All types of resins having practical importance are produced in Italy, so molders, extruders, and other processors have the choice of a complete assortment, in no way different from those of the more advanced industrial countries like Germany and England.

Among the Italian firms that produce resins, the Montecatini Group of Milan, which includes also ACNA, Polymer, and Rhodiatoce, dominates the scene. Over half of the Italian consumption of plastics is covered by the Montecatini Group which probably is the only

*Commercial Co-Director, Montecatini.

Presented here is the sixth article in the series "Wide World of Plastics" which started in our May issue.

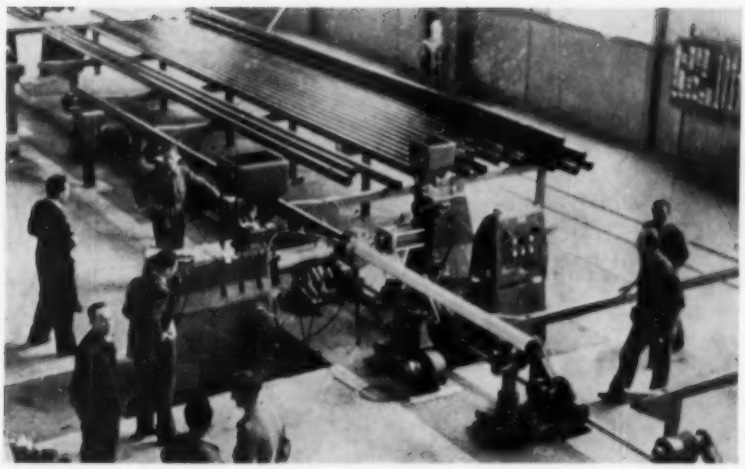
These authoritative articles are written by plastics publication editors or industry leaders. The purpose of the series is to show the progress of plastics throughout the world.

In each succeeding issue, countries not checked in the list at the right will be represented.

- Argentina ✓
- Australia
- Belgium
- Brazil
- Canada
- Denmark
- France ✓
- Germany (West)
- Great Britain ✓
- Holland
- India
- Israel ✓
- Italy ✓
- Japan ✓
- Mexico
- New Zealand
- Norway
- South Africa
- Spain
- Sweden
- Turkey

✓ Covered in this issue

✓ In previous issues



1

Two materials extrusion-coated on pipe

An outstanding Italian plastics development is the continuous coating of the exterior of large-diameter steel pipe through a special die simultaneously fed by two extrusion machines. One machine applies a first coating of polyethylene; the other extrudes polyvinyl chloride compound on top of the polyethylene in a single operation. See photo 1.

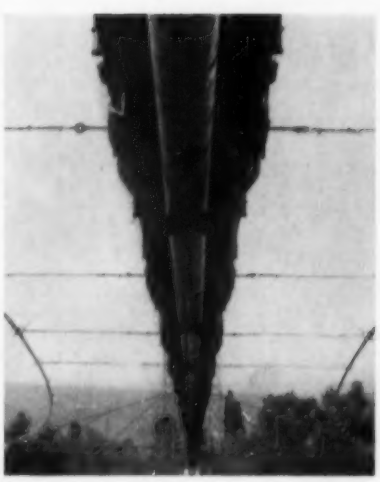
From the standpoint of protection of the pipe, the inner layer of polyethylene gives resistance to acids and electrolytic action; the outer vinyl layer gives resistance to abrasion, etc.

When laying the pipe in the field, in order to secure continuity of the covering at the joints, one of two systems may be used. The first consists of using polyethylene and vinyl tapes to make a spiral covering. The second, illustrated in photo 2, consists of introducing on one of the two pipes, before welding them together, a sleeve of elastomeric vinyl material. After the metal welding operation, the sleeve is placed on the junction and then, by placing a vinyl adhesive layer between the sleeve and the covering, a good seal is obtained.

Photo 3 shows two-layer coated water pipe slung on cables under a bridge.

The extrusion coating technique, the die design, and the method of joining pipes were developed by Roberto Colombo of Lavorazione Materie Plastiche, Turin, Italy.

2



3

firm in the world that can offer to its clients such a vast assortment of synthetic resins. It produces phenolics, urea, melamine, styrene, vinyls, polyethylene, nylons, polyesters, and a rich series of special resins such as ion exchange, fluorocarbons, and the isotactic polymers.

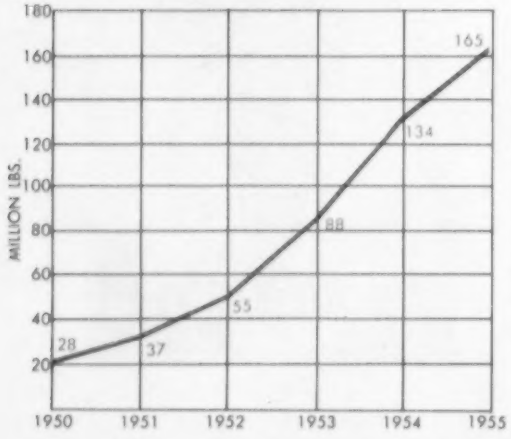
Other important producers are Monti & Martini of Milan which makes certain types of phenolics and urea resins, the Società Italiana Celluloide (S.I.C.) of Castiglione Olona (Varese) which produces cellulosic and styrene resins and semi-finished products; Sicedison and Solvic, both of Milan, which specialize in polyvinyl chloride; the Società Italiana Resine of Milan which produces phenolics and urea resins; Resia of Casoria (Naples) which manufactures protective coating resins; Vetrocoke of Turin for semi-finished polymethacrylate products; Ciba of Milan, sister company to the Swiss firm of the same name, which produces phenolics, melamine, and epoxy resins; Saint Gobain of Milan, sister company to the French Saint Gobain, Chauny, Cirey & Co., which produces silicone resins.

By far the greater part of the plants of companies that produce resins are located in Northern Italy, in and around Milan, at Porto Marghera near Venice, and at Ferrara, while others are located in central Italy, at Terni in Umbria; and in the South, near Naples.

Table I: Predicted growth of resin consumption in Italy

	1955 Consumption, 1000 lb.	1956 Estimated consumption, 1000 lb.
Styrene polymers	13,228	15,432
Acrylics	3,858	4,409
Vinyls	37,478	48,501
Polyethylene	8,157	11,023
Nylons	110	176
Cellulosics	12,126	13,228
Phenolics (molding and industrial resins)	28,219	39,683
Amines (melamine and urea)	39,242	42,769
Polyesters	1,103	3,307
Others	22,046	28,660
TOTAL	165,567	207,188

Growth of Italy's consumption of all plastics



Plastics processors

Industry growth at the level of processing plants and equipment, is also steady. In 1955 there were 1200 processors (molders, extruders, calenderers, spread coaters, vacuum formers, etc.); in 1956 that number should increase to 1250. And here is the picture of growth in equipment:

	1955	*1956*
Injection presses	1500	1650
Compression presses	3000	3150
Calenders	20	24
Extrusion machines	1000	1200

The Italian market

In spite of relatively limited quantity consumption which does not permit mass production of any one item, the Italian market features a very complete variety of manufactured articles. Since every resin is produced in the country and since the Italians have a tradition of technical and tooling skill, our plastics product and component quality can be high. However, contrary to what happens in some other countries, where tendencies are towards uniform production on restricted quality standards, Italian production is characterized by a great number of different patterns, types, and qualities. Thus, many processing methods must be used, and tooling costs and equipment may not be charged to long runs or to a relatively few products.

Italian use of resins

It may interest readers of MODERN PLASTICS to study the variety of uses to which Italian-made plastics materials are put.

Table II: Who makes what plastic in Italy

	Phenolics	Urea	Melamine	Styrene	Acrylics	P.V.C. & cop.	Vinyl acetate	Vinyl acetals	Vinyl alcohol	Polyethylene	Fluoroethylene	Cellulose nitrate	Cellulose acetate	Alkyd	Polyesters	Polyamides	Silicone	Epoxy	Ion exchange
A.C.N.A.						●													
ALCREA	●				●									●					
C I B A	●	●	●															●	
L E R I	●	●													●				
MONTECATINI	●	●	●	●	●	●		●		●	●	●			●	●			●
POLYMER (Gruppo Montecatini)						●	●		●				●						
RHODIATOCE (Gruppo Montecatini)							●		●				●			●			
STAMPALIA (Gruppo Montecatini)		●																	
MONTI & MARTINI	●	●																	
PASQUETTI													●						
RESIA	●	●					●							●	●				
SADAF		●																	
SAINT GOBAIN																	●		
S.I.C.				●								●	●						
SICEDISON						●	●												
S I R	●	●																	
SOLVIC						●													
VETROCOKE					●														

Phenolics: Phenolic molding powders are employed for all standard articles manufactured in most other countries, but some molders in Italy have put all their efforts into specialized types of production, which has permitted them to do some good export business. For instance, some have specialized in toilet seats and bathroom cupboards, electric equipment, and electronic parts.

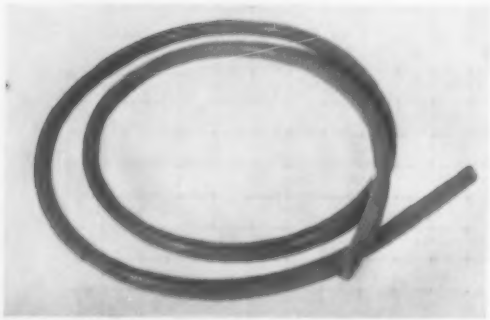
Rubber-phenolic molding compounds, rapid-hardening phenolic molding materials, and casting phenolics, which are also produced in Italy, complete the series of these resins.

Phenolic industrial resins are used in adhesives for plywood for aviation and naval purposes, in structural boards, impregnated paper, and laminates, and in bonding agents for abrasive wheels.

Urea and melamine: There is a large consumption of urea molding powder due to the fact that bright colored objects, which have great appeal to the public, can be made with them and also on account of the button indus-

Realistic artificial snow used in this scene from the motion picture "War and Peace" consists actually of expanded urea resin. (Photo Montecatini)

Large drum, produced by Pirelli Co. in Italy of high-pressure polyethylene, has capacity of 190 gallons. (Photo, Montecatini)



Garden hose of polyvinyl chloride, reinforced with cotton mesh, is produced by F.A.P. of Italy. (Photo, Montecatini)

Steering wheel molded of one of new isotactic polymers. (Photo, Montecatini)

Blown unplasticized P.V.C. bottles made by Pirelli Co. (Photo, Montecatini)

try which is flourishing and has a big export trade.

Closures, electrical appliances, radio cabinets, and visible parts of electrical equipment are also manufactured from aminos.

Urea resins are widely used as adhesives for wood, especially for plywood and wood-waste panels. There are special types for paper treatment and for protective coatings.

Melamine molding powders are used principally for the manufacture of dinnerware and for decorative laminates. Some 508,000 cu. yd. of plywood and about 2,400,000 sq. yd. of melamine laminates were produced in Italy in 1955.

Polyesters: Reinforced corrugated roofings are the chief application of the polyesters in sunny Italy. But in low-pressure molding practically everything that has been done elsewhere has been done here. Motor car parts, boats, fishing rods, chairs, trays, and boxes can be included in the list as well as some production of polyester-paper laminates.

Styrene: Only Montecatini in Italy produces styrene monomer as well as styrene polymers; the Società Italiana Celluloide has only the equipment for polymerization.

All types are produced: high impact (alloy) styrenes, styrene-acrylonitrile copolymers, and specialties such as electro-static-proof and heat-, gasoline-, and light-resistant types.

In addition to the more usual methods of producing and finishing polystyrene articles, the technique of high vacuum metallization is widely employed in Italy. Montecatini and the Società Italiana Resine manufacture also extruded oriented sheets of high-impact styrene in a vast assortment of colors and gages suitable for vacuum forming.

Acrylics: Methyl-methacrylates are manufactured in Italy in the shape of sheets, blocks, tubes, and rods, but these semi-finished products as well as other acrylic materials are also imported. All methyl-methacrylate molding powders are at present imported but Montecatini has announced a large production program for acrylics and methacrylates which should fill this gap (perhaps the only one) in the large field of the more commonly used plastics.

Vinyls: Polyvinyl chloride production is considerably greater than Italian consumption and a fair amount is exported to the principal countries, including Germany and the United States.

Numerous types of vinyl are (*To page* 198)

Hearing glasses

Plastics eyeglass frames team with component miniaturization to give greater comfort to the hard-of-hearing

Miniature hearing aid, designed around printed circuitry, transistors, etc., is small enough to fit into the hollow temple of molded plastic eyeglass frames. Only exposed part of the device is tiny tube that extends from receiver to ear. (Photos, Beltone Hearing Aid Co.)

Personal vanity which has often discouraged the hard-of-hearing from wearing conspicuous hearing aids has been successfully catered to in the design of "hearing glasses"—smartly styled plastics eyeglass frames with hollow temples that house a complete hearing aid. The ability to design an aid that will fit into such a narrow compartment is a reflection of the strides being made in the miniaturization of electronic equipment—based largely on the use of printed circuitry and transistors. In each of the several models on the market today, sounds are carried from a miniature receiver in the temple section (either right or left) through a tiny, almost invisible, plastic tube to the ear. There are no outside receivers or cords, no headbands, and no other external devices that need be camouflaged in any way.

The light weight, attractiveness, adaptability to functional design, and toughness of plastics all contributed much to the development of hearing glasses. And so enthusiastic has been the consumer response to the idea that one leading hearing-aid manufacturer, Otarion, Inc., Dobbs Ferry, N. Y., already reports that 80 to 90% of its production has swung over to plastics hearing-aid eyeglasses. Frames and other parts for Otarion's "Listener" are molded of cellulose acetate butyrate.

Beltone Hearing Aid Co., Chicago, Ill., another leader in the hearing-aid field, also reports considerable success with their plastic "Hear-N-See" hearing glasses. Components of the Beltone model are all molded of styrene-acrylonitrile.

Injection molded parts

In contrast to the conventional method of producing eyeglass frames (by die cutting from plastic sheet stock), all the parts for the Otarion "Listener," with the exception of the frame front, are injection molded of H-flow cellulose acetate butyrate in black, mottled red, or mottled brown. Because of the large number of sizes and patterns required for the frame fronts, it was found to be more economical to die cut these from slabs. Injection molded rectangular slabs, 0.225 in. thick, are used instead of sheet stock to get the same mottled effect in the frame front as there is in the other molded parts.

All these other parts for sets of left-ear and right-ear hearing-aid glasses of varying sizes are turned out in three molds with a total of 44

Transparent demonstration model of "hearing eyeglasses" shows contoured cavities and openings molded into plastic temples to accommodate hearing aid components. (Photo, Otarion, Inc.)

cavities—no two of which are alike. One mold has four large cavities for a left and right temple section into which the receiver assembly fits and a left and right temple section for the amplifier assembly; the second mold has cavities for the amplifier and receiver temple covers, battery compartment cover, and the other small, flat pieces; and the third mold has cavities for the receiver, receiver cover, volume control knob, and volume control knob screw cover.

Because of the varying cross sections in the different groups of pieces, different combinations of temperature and pressure (averaging out to about 450 to 500° F. and about 900 p.s.i ram pressure) are necessary to get the same type of flow pattern in each set of cavities. When working with mottled colors, it is also necessary to change the ratio of the color mixes for different cross sections, in order to obtain the same general effect in the final color formulation.

To facilitate assembly, seats for the miniature receiving and amplifying units are molded into the deep half of the temple. Separating walls and holes for the threaded bushings that support volume controls, amplifier chasis, etc., are also molded into this section. After the hearing-aid parts have been fitted into place in the temple, a flat cover is solvent-cemented in place. Provision is also made for removable sections that permit easy access to batteries in the event that it should become necessary to change them.

Advantages of butyrate

According to Otarion, the ease with which the various butyrate parts could be solvent-cemented together was one of the main reasons for selecting the material for the application. Other reasons: ease of molding in complex cross sections, flexibility, toughness, light weight, and the ease with which cemented and sanded surfaces could be buffed for a high finish.

The other major plastics components in the design of the "Listener" are the rigid molded acrylic ear-piece and the flexible, transparent vinyl tubing which runs from the receiver unit to this ear-piece.

Beltone's molded styrene-acrylonitrile "Hear-N-See" glasses have much the same design features as the "Listener." Each of the hollow temples in the "Hear-N-See," however, can be fitted with a complete, independent hearing aid, thus making it possible for the instrument to deliver either monaural or binaural hearing. The choice of styrene-acrylonitrile was also based on the material's toughness, resiliency, resistance to body acids, and the ease with which it could be molded into utilitarian hearing-aid eyeglass frames—as attractive as they are functional.

Credits: Tenite butyrate for Otarion's "Listener" supplied by Eastman Chemical Products, Inc.; Styrex styrene-acrylonitrile for Beltone's "Hear-N-See" supplied by The Dow Chemical Co.

All cellulose acetate butyrate components of Otarion's "Listener" model (below) are injection molded, with the exception of the eyeglass frame front, which is die-cut from an injection molded slab of butyrate (left). After electrical parts have been installed, temples are solvent-cemented together; removable sections permit access to batteries. (Photo, Otarion, Inc.)

At the 7th N.P.E. and the 1956 National S.P.I. Conference

Over 28,000 industrial executives attended the 7th National Plastics Exposition in the Coliseum in New York, June 11-15; some 1200 of these were from foreign lands.

By every criterion, this was the finest Plastics Show to date. The exhibits were tremendously exciting in terms of trends and developments shown, were sound and practical in presentation of new and projected applications, were the open door to colossal new markets for plastics, particularly in the areas of composite structure, automation, large parts, and decoration.

Materials

News on plastics materials got off to a booming start several days before the Exposition with Prof. Natta's press interview concerning Montecatini's polypropylene and Du Pont's announcement that they were building facilities to double their present high-pressure polyethylene production. Prof. Natta stopped in New York on his way to attend the Gordon Research Conferences in New York and the Notre Dame Conference in July where he will discuss the subject of isotactic polymers produced from olefins by new catalysts which eliminate the need for high-pressure equipment. Prof. Natta and his associates displayed products made from polypropylene by this method (later shown at the Exposition) that is similar to other low-pressure polyethylenes but is claimed to have even greater heat resistance, less waxy surface, and greater strength. Film and monofilaments on display were notable for clarity and most unusual tensile strength. Polymerized polypropylene is potentially lower in cost than polyethylene, according to Montecatini spokesmen, but is currently being sold in Italy from a pilot-plant production at 43¢ a lb., the same price as polyethylene in that country. Licensees will be announced in due time.

The Du Pont announcement that they were doubling their present capacity for high-pressure polyethylene was particularly important because it conveyed the company's confidence in the future of high-pressure polyethylene, especially their high-density material which has heat-resistance and stiffness properties approaching those of low-pressure or linear polyethylene. This new type high-pressure polyethylene is particularly valuable for imparting clarity to film, and stiffness, together with greater heat resistance, to molded items. The additional facilities will give Du Pont an estimated capacity of 200 million lb. of high-pressure polyethylene.

Other news of polyethylene included were Bakelite's notice of intent to construct low-pressure plants at Institute, W. Va., and Sea Drift, Texas, with a combined capacity of 55 million lb. so that, when completed, Bakelite will have a total capacity of more than 300 million lb. of both kinds of polyethylene. Bakelite also announced the introduction of a new high-density, high-pressure polyethylene molding material to be called DND-0400 which, of course, has the better heat resistance and stiffness properties of the new high-density, high-pressure polyethylenes.

Another interesting polyethylene feature was the foamed sheet displayed by Phillips. They will be used for insulation if they ever become practical; they are not to be confused with polyethylene foam used for wire coating.

Hooker-Durez displayed a filled polyester molding material in attractive colors and also an epoxy paint-coated phenolic molding material that can be used for appliance handles and other phenolic parts. The new coating can be applied cheaply and efficiently to give phenolics a most attractive sales appeal that has been lacking in the past.

General Electric brought out a new fast-cure general-purpose phenolic molding material, engineered to reduce mold wear as well as to shorten the molding cycle. Another new phenolic compound is their one-stage formulation especially designed for automatic production of refrigerator parts, distributor caps, rotors, and automotive switch parts.

Higher heat resistance

American Cyanamid concentrated attention on their new methylstyrene Cymac 400 and acrylonitrile-methylstyrene copolymer Cymac 201. Cymac 400 is to be sold at the same price as general-purpose polystyrene but is claimed to have higher heat resistance. It may be repeatedly heated at 212° F., with less than 0.31% shrinkage. It is suggested especially for items that have to be washed in hot water, such as trays, picnicware, and potato salad containers. Cyanamid claims that its new Cymac 201 has greater heat resistance than similar compounds now on the market. Suggested for fan blades, battery cases, radio cabinets, and pen barrels, it is priced at 41¢ a pound.

Dow Chemical emphasized its recently announced four new modified polystyrenes, two of which are high-impact materials with greater heat resistance than older formulations; one general-purpose material tailored for extrusion; and another especially tailored for easy flow when molding thin sections. Still another styrene-type compound is Dow's new styrene-acrylonitrile copolymer for such products as tumblers, cutlery handles, rigid food containers, bristles, and aerosol nozzles which will become commercially available this fall.

Monsanto chose to emphasize products rather than

materials but did put stress on its new polystyrene which combines better clarity with high impact. The opacity of the new material is 50% less than that of standard high impact, but strength properties have not been sacrificed. The new material is specially suggested for food packaging.

Good flow

Celanese's new Forticel, a cellulose propionate molding material, was emphasized as a product with good flow and unusually fine finish for such uses as mechanical pens and pencils, telephones, auto steering wheels, and housings. It will eventually be available in film form.

Penton, the new resin derived from pentaerythritol by Hercules, was displayed for the first time in public. It is still developmental and in the $5- or $6-a-lb. class but will eventually cost around $2. It is thermoplastic but hardens in a strain-free form by crystallizing rather than by heat removal. Changes in temperature do not cause the molded pieces to warp. Water absorption is 0.01%, which is almost negligible. It has dimensional stability of an order not previously attainable in plastics materials and retains its strength at higher temperatures than most thermoplastics.

Equipment

If the rich variety of new plastics equipment had to be described in one word, that word would be "automatic." All the important production machines have at least some automatically controlled operations. Automation has begun to invade the auxiliary equipment lines, too. Another visible trend in machinery making is the greater power and "beef" that many manufacturers are putting into their machines. And the new machinery operates so much more quietly!

Injection machines, compression presses

At least eight brand-new injection machines were on display at the show, most of them running. Several of the smaller ones were knocking out pieces so fast that they seemed more like punch presses than molding machines. Many makers have "souped up" their machines, raising motor horsepowers as much as 50% to get greater speed and faster filling. Two firms have just entered the injection-machine field with small, fully automatic machines and they expect to be making larger ones soon. One, a ¾-oz. machine, embodies a simple new drive that is described in detail on pp. 118 to 125. The other, a vertical 2-oz. machine, even separates runners from parts (see pp. 163-4).

A significant development in injection molding is the effort to control pressure in the mold, by three quite different methods. A new weigh feeder accomplishes cushion control by splitting the feed shot into two portions; the major portion is delivered first, and the minor portion is delivered only if the injection plunger reaches a preset minimum position. Two other devices, with different sensing systems, detect the pressure in the injection nozzle and uses the information to control the holding pressure on the ram. Thus a preset nozzle pressure (and mold pressure) can be maintained on each shot, eliminating short shots and over-packing.

Featured on one 12-oz. and another 2-oz. machine was an automatic hopper loader, a simple pneumatic conveyor that keeps the feed hopper filled to the desired level from a drum. One maker's new 2-oz. machines, in three models, are claimed to be the "world's fastest" and can dry-cycle in 3 seconds. Another fast 2- to 3-oz. machine was busily making disposable polystyrene cups with 15-mil walls in a 2-cavity mold on a 5.3-sec. cycle, with no help from anyone!

A new 50-ton, fully automatic compression press, looking like a lonely, engrossed robot, was coughing up fluorescent tube mountings from a 9-cavity mold every 40 seconds. Not far away, a 75-ton cousin, using direct powder feed without preheat, was making slightly larger parts on a 110-sec. cycle. Will the next step be built-in preheating? These machines can already dry-cycle in a small fraction of the curing time. A pair of 60- and 100-ton presses are leaning in that direction with their adjustable loading boards and automatic preheaters operationally linked to the press to get very short over-all cycles (see MODERN PLASTICS 33, 152, 154, May 1956).

Vacuum forming machines

New vacuum forming machines with faster heating and greater versatility (or, sometimes, sharper specialization) are blossoming forth like dandelions. One was forming whole toy auto bodies 5 ft. long, 2½ ft. wide, and 1 ft. deep.

Extruders

With one startling exception, extruder makers are going to longer barrels and higher-powered drives. L/D ratios up to 24:1 are now being offered as "standard equipment." This reflects the rising interest in working the heat into the extrudate as against pouring it in with heaters. As in injection cylinders, larger heated areas allow heaters to run at lower temperatures. One exception, a machine said to deliver up to 115 p.p.h., has a 5-hp. drive, a short screw, and a heated zone only 4 screw diameters long (see MODERN PLASTICS 33, 280, June 1956).

A very impressive showing was made by a newcomer to the extruder-making field, whose extruders had many construction extras, including recorded melt temperature at the die and a versatile temperature-control system. The vented 8-incher is said to deliver 2000 p.p.h. of styrene-alloy sheet.

Very pretty also was a new 1-in. laboratory extruder, equipped with a melt-pressure gage at the end of the metering zone and a melt thermocouple in the die adapter. One maker is introducing a "vapor-pressure" temperature-control system in which either water or Dowtherm is circulated under pressure in a multi-zone jacket with reflux condensers. The result is fast and uniform temperature control. A brace of extremely ingenious triple-screw extruders can spiral-coat tricolor insulation on two wires at once, at rates up to 70 f.p.m.

A dual weigh-feeder will independently weigh and proportion rework and virgin feeds, dumping them together into an injection feed hopper. Preplasticators were disappointingly conspicuous by their scarcity in the 6-oz.-and-larger injection machines on display. Apparently their money-saving advantages are not widely understood. Mixers and cutters have been beefed up, but here automation has had negligible impact. There still seems to be no continuous mixer available for plastics compounding. A thermoset preheater automatically takes powder (or preforms) from a hopper, preheats it, and apportions it to the mold cavities on very fast cycles. Many new automatic finishing devices and aids were on display.

Applications

Even those veterans of the plastics industry who have been seasoned by the expansion of the past decade were taken aback by the quantity, variety, and high caliber

of the plastics products displayed at the Exposition. Application-wise, here are some of the impressions made upon visitors to the more than 330 exhibits.

Products vacuum formed or pressure formed from thermoplastics sheets occupied a good share of the Exposition. Taking advantage of recent refinements in forming techniques, most of them were larger in size, more complex in shape, and finished off in more exciting color and surface treatments than in the past. One of the largest of these new pieces was a lightweight miniature toy automobile body formed in one piece of rubber-modified styrene sheet stock. Another was a complete one-piece refrigerator inner shell, formed of rigid vinyl sheet stock, incorporating contoured shelf supports.

Particular attention was paid in the design of the equipment for automated processes to bring sheet-formed plastics applications into a more favorable cost position—even in low-cost "disposables." Pointing up some of the possibilities was a pressure-formed disposable vinyl speculum used in nose and ear examinations. Turned out on a continuous basis by a specially designed forming operation, the specula are expected to be produced at a rate of 200 million units annually.

Future possibilities for sheet-formed plastics took on an even brighter note in the emphasis placed on predecorated high-impact styrene sheet with such consumer-appealing patterns as wood grains, marble effects, and high-fashion designs. Attractive end products made from such sheet, including refrigerator door panels, trays, luggage, etc., indicate that suppliers are well aware of the lucrative market potential inherent in these materials.

Packaging uses

In this same area of vacuum and pressure forming, considerable interest was expressed by Exposition visitors in advances in the technique of "skin" and "blister" packaging and in the strides being made in forming rigid and semi-rigid vinyls and styrene copolymer sheet materials into large-volume automotive and industrial applications.

Structural and decorative applications in the building field, ranging from vinyl wall coverings and laminate counter tops to sinks and lavatories formed of acrylic or other thermoplastic sheet, also stood out as examples of the lucrative markets which are beginning to find large-volume use for plastics materials. Two major raw materials suppliers displayed model homes containing a variety of practical applications for plastics. One, labeled "The House of Today," demonstrated uses for vinyl materials in the home—rigid vinyl piping, lighting panels, gutters and downspouts, and house sidings; vinyl-coated radiant heating wire; and flexible vinyl upholstery. The other, virtually all-plastics and described as "The House of Tomorrow," was designed around a U-shaped molded unit which forms part of a room's ceiling, walls, and floors, and incorporates movable walls and partitions based on plastics sandwich materials.

Similarly, automotive applications in plastics occupied a place of prominence in a number of booths. Most in evidence among these applications were instrument crash panels fabricated of vinyl, styrene copolymer sheeting, or polyester-fibrous glass laminate, backed up with foamed-in-place vinyl or polyurethane. Many automobile manufacturers have expressed the opinion that within five years padded dashboards will become standard automotive equipment.

Most of the other new automobile applications centered around parts formed of resilient styrene copolymer sheeting and fabricated of glass-polyester laminate. In the latter category, particular emphasis was laid on panels, housings, and trim molded of the new glass-reinforced polyester molding compounds (premixes). One of the most exciting of the new product developments along these lines was a complete inner door liner molded of a premix material for the Lincoln Continental.

Large one-piece components

In both the building and the automotive fields, as well as in a number of other areas, there was a definite trend toward the use of extremely large one-piece molded plastics components, particularly where the polyester- or epoxy-glass laminates are involved. One of these, a small utility car 3 ft. high and 10½ ft. long, mounted on a three-wheeled chassis, featured a reinforced plastics body assembled from only two molded pieces. A number of one-piece reinforced plastics boat hulls (some as large as 16 ft.) also dramatized the trend toward larger component parts. Also on display was a large one-piece matched-metal molded inner door panel for coolers and for vending machines dispensing iced drinks. One advantage of the panels lay in their strength characteristics at low temperatures.

Further evidence that the plastics industry is thinking along the lines of larger and more important products was a 12-ft. refrigerated truck body fabricated in one piece of sandwich materials in which polyester-fibrous glass laminate forms the inner and outer skins and balsa wood is the core. Light in weight, sturdier than conventional metal bodies, and with vastly superior insulating characteristics, the new truck body opens the way to even larger structures, including refrigerated railroad cars.

Also of interest in the field of resin-glass laminates were: 1) A large conical refueling drogue which is used at the end of the boom through which jet aircraft are refueled in flight. The drogue, molded of an epoxy-fibrous glass laminate, is light in weight, yet sturdy, and, being non-metallic, eliminates any possibility of dangerous sparking when the cap is brought into contact with the plane for the refueling operation. 2) A combination reinforced plastics camp trailer and boat in which the boat, when inverted, fits flush on top of the trailer, giving the entire unit a low profile and center of gravity for increased safety. 3) A ladder made from sandwich-type materials, with polyester-glass mat as the skins and balsa wood as the core. Advantages of the ladder are claimed to be strength, light weight, and the fact that the material does not conduct electricity and hence can be used in the telephone and electrical industries.

Large polyethylene pieces

Polyethylene also showed up in quantity in various applications—and again large one-piece products were most in evidence. Nearly every supplier of polyethylene resins had on exhibition a number of large housewares articles, including wash basins, tubs, and a wide variety of buckets and pails. One of the largest of the pieces in this category was a 22-gal. polyethylene trash can with a separate polyethylene lid.

Prototype products molded of the new low-pressure polyethylenes included bottles and jars, dust pans, buckets, pitchers, combs, pickling tanks, and corrosion-resistant valves. Coatings based on the new materials (including one that can be flame-sprayed on metal) and extruded filaments for braided rope were shown.

Numerous applications of metallized plastic films as durable, tarnishproof decorative trim in the automotive, furniture, appliance, and other fields showed the rapid progress made by these versatile new materials. Also

displayed was another type of trim in which metal foil is sealed within an extruded plastic channel or other continuous section—again eliminating the tarnish problem, and at the same time protecting the surface of the metal foil with the transparent plastic sheath.

Many of the booths highlighted the growing importance of plastics in the packaging field. Injection molded styrene containers, turned out on an automatic cycle at the rate of one unit every four seconds, were but one example of progress, and there was increasing emphasis on automated sheet forming. A major trend in packaging, clearly apparent at the Exposition, is the extension of the disposable package concept to drinking cups, fruit and berry containers, and other throw-away units of various kinds.

Over-all, most of the other plastics products were accepted applications—housewares, tumblers, radio cabinets, toys, and miscellaneous consumer and industrial items. Throughout, these products showed the effect of up-grading based on stronger, more functional materials and better engineering as a result of new processing techniques. The higher-impact or styrene alloys, for example, seem to be moving into many areas traditionally serviced by conventional styrene—and, at the same time, opening up entirely new fields. One supplier of a high-impact styrene showed prototype models of ladies' shoe heels, lampshades, and "unbreakable" toys. Another placed emphasis on a new sun-powered tubeless radio housed in an extra-high-impact case carrying a five-year guarantee. This same radio incorporates an acrylic window to cover the 32 silicon cells which convert sunlight into electricity. Similarly, tough new cellulosics were being promoted for radio cabinets, pen and pencil barrels, and kitchen utensil handles.

The growing use of selected plastics in tooling, not only for forming thermoplastic sheet materials but also in the metalworking field, was amply demonstrated by cast epoxy and phenolic dies used in production of various types of parts. Progress being made in slush molding and centrifugal casting of vinyl plastisols was indicated by such products as balls, toy animals, and various novelty items.

Foams on display

Almost unknown, except for very limited applications, at the time of the 1954 Plastics Show in Cleveland, some of the newer plastic foams—notably vinyl and polyurethane—were much in evidence at this year's Exposition. These foams are now coming into a wide range of applications in furniture, automotive crash panels and safety-type sun visors, and numerous other products. Another relative newcomer, expandable styrene, is being used in producing items ranging from small decorative and protective packages to life preservers and net floats.

SPI Conference report

This year's National Conference was marked by large attendance at all sessions, by the use of panels so that subjects might be thoroughly covered, and by concurrent specialized sessions. Literally the whole range of end-use interest in plastics was covered, from plastics as building materials to plastics in packaging.

Because there were no advance copies of papers or abstracts available, the following report is one of impressions and opinions developed by attendance of the MODERN PLASTICS editorial team at the Conference sessions.

Cellular Plastics Session

The one particularly impressive point of the session on cellular plastics (foam and sponge) was that no one knows which type of foam or sponge is going to be predominant five years from now. Producers all profess confidence in their particular type of material, but most users, if the speakers at this meeting are typical, are inclined to hedge. Cost, properties, and performance, at least insofar as they relate to vinyl and urethane, are still undetermined. It is going to require several years of testing and improvements in production techniques before the issue is settled. Even then it is very possible that each different foam or sponge may find a market of its own with not too much conflict between them.

One of the big markets that the flexible foam producers are gunning for is upholstery—it is also the most controversial of all.

The speaker from the New York City Transit Authority cast a great deal of light on why there has been so much confusion concerning which foam was being used for subway car cushions. The answer is that his organization is "testing" them all. There will be no final decision for several years. There are over 1000 cars involved and specifications are exceedingly difficult to write because of varying performances of the different materials and lack of available information. Consequently, the specs are frequently changed, which adds to the general confusion.

Flexible foam in automobiles is far more than just a possible upholstery material. Its use for safety padding and sound deadening could result in the production of an automobile that would be akin to a padded cell. A different angle in this situation is the great interest in polyether foam which reportedly has a compression-set property approaching that of rubber latex which up to now has been more satisfactory for automobile upholstery than vinyl or urethane. Vinyl foam has the advantage of heat-sealability; on the other hand, there is the possibility of making urethane foam cushions by simply pouring the compound into a mold where the covering material has been placed and thus producing a complete cushion in one operation.

Railroad cars, too, are great prospects for foam, especially rigid foam. One car builder is now using 220 cu. ft. of rigid isocyanate foam in all new cars. He is also interested in and has used rigid polystyrene foam, polystyrene bead foamed-in-place material, and phenolic foam. The latter is of considerable interest as thermal insulation, especially in sandwich constructions. But the foamed-in-place isocyanate seems to be moving fastest in the railroad car industry where a material must be used that will withstand 220° F. The car builders like isocyanate because it requires no adhesive for attachment to side walls and can be used in extremely low densities.

Perhaps the greatest potential of all for rigid foams was suggested by the Navy. All ships have tremendous void spaces; it would be desirable to fill those spaces with a light fire- and water-resistant material. Various rigid foams are being tried. In fact, the Navy is using foam at a good rate right now for life preservers, boat

Papers and Authors

Cellular Plastics Session

Theme: *"Cellular Plastics in the Transportation Industry"*

Opening Remarks: Dr. Samuel Steingiser, Mobay Chemical Co.

Presiding: Dr. Paul Roach, U. S. Rubber Co.

"Cellular Plastics Applications in Ships"—John B. Alfers, U. S. Department of the Navy, Bureau of Ships

"Cellular Plastics in Subway Seating"—James R. McCormick, New York City Transit Authority

"Uses of Cellular Plastics in the Aircraft Industry"—Stanley T. Lippert, Douglas Aircraft Co., Inc.

"Cellular Plastics in the Automotive Industry"—E. J. Storfer, Chrysler Corp.

"Applications for Cellular Plastics in Trains"—Dr. Irving Einhorn, The Budd Co.

Sheet Forming Session

Presiding: John W. Knight, The Fabri-Form Co.

"Use of Sheet Formed Plastics in Packaging Applications"—Robert N. Fisher, The Stanley Works

"Applications and Requirements for Formed Sheets in the Appliance Industries"—Robert Dixon, Westinghouse Electric Corp.

Panel Discussion—Transportation Applications for Sheet Formed Plastics

Moderator: A. E. Polson, Goodyear Tire & Rubber Co.

Automobiles—Richard F. Hintermeister, Ford Motor Co.; *Trains*—Ralph Haman, Pullman Standard Car Manufacturing Co.; *Aircraft*—Harold H. Rosenbaum, Convair, a Div. of General Dynamics Corp.; *Ships*—F. A. Heess, Jr., Moore-McCormack Lines, Inc.

General Session

Keynote Addresses on the Theme: *"Plastics Shaping Tomorrow's Products"*

Opening Remarks and Presiding: Wm. T. Cruse, Executive Vice President, The Society of the Plastics Industry, Inc.

Principal Speakers: *Automotive*—Harry E. Chesebrough, Executive Engineer, Chrysler Corp.; *Packaging*—C. W. Harper, Manager, Informative Packaging and Labeling Div., Sears, Roebuck and Co.; *Building Materials*—Ralph Walker, F.A.I.A., Voorhees, Walker, Smith and Smith; *Refrigeration and Air Conditioning*—George Taubeneck, Editor, "Air Conditioning and Refrigeration News"; *Communications"*—Dr. W. O. Baker, Vice President of Research, Bell Telephone Laboratories, Inc.

Automotive Session

Presiding: W. M. Porter, Celanese Corp. of America, Plastics Div.

"Trends in Automotive Styling"—Duncan McRae, Director of Styling, Studebaker-Packard Corp.

"Plastics Automotive Components"—Dr. A. J. Carter, Chrysler Corp.

"Advances in Body Manufacturing Techniques"—John G. Coffin, Chevrolet Div., General Motors Corp.

Packaging Session

Presiding: S. W. Jones, Jr., M. W. Kellogg Co.

"New Developments in Flexible Packaging"—Thomas R. Baxter, Gen. Mgr., Research and Development, Flexible Packaging Div., Shellmar-Betner Div., Continental Can Co., Inc.

"New Developments in Rigid Packaging"—Lloyd Stouffer, Editor, "Modern Packaging Magazine"

"A Review of Vacuum Formed Visual Packages"—E. Bowman Stratton, Jr., The Auto-Vac Co.

"Progress Report on FDA Legislation"—Elliott Balestier, Jr., Assistant to President, The Visking Corp.

Building Materials Session

Presiding: David Guarnaccia, Monsanto Chemical Co.

"Plastics Today in Buildings"—Dr. Albert G. H. Dietz, Professor of Building Engineering and Construction, Massachusetts Institute of Technology.

"Approach to Code Problems"—F. J. Rarig, Acting Secretary, Rohm & Hass Co.

"Plastics Tomorrow in Buildings"—Robert Fitch Smith, Architect, A.I.A.

S.P.I. Annual Meeting

Presiding: Norman Anderson, President of S.P.I.

Address: *"Status of Federal Communications Commission's Proposed Changes in Rules and Regulations Covering the Use of High-Frequency Equipment for Molding and Heat Sealing"*—Jerome H. Heckman, Dow, Lohnes and Albertson

International Reception and Dinner

Presiding: Tino Perutz, Omni Products Corp.

Accredited Overseas Visitors spoke on conditions in the Plastics Industry in their respective countries

Refrigeration and Air Conditioning Session

Presiding: Islyn Thomas, Newark Die Co., Inc.

"Sheet Forming and Extrusion"—D. A. Davis, Chemistry Laboratory, Major Appliance Div., General Electric Co.

"Moldings"—Roy V. Johnson, Midwest Mfg. Corp., Engineering Dept.

"Insulation"—O. H. Yoxsimer, Westinghouse Electric Corp.

Communications Session

Presiding: George H. Reed, American Hard Rubber Co.

"Trends in Extrusion Materials for Communications Wire and Cable"—Co-authors, J. B. Howard and V. T. Wallder, Bell Telephone Laboratories, Inc.—Delivered by J. B. Howard

"Encapsulation and Miniaturization"—William Cuming, Emerson & Cuming, Inc.

"The IBM Molded Flush Circuit"—Richard M. Bell, Manager, Plastics Laboratory, International Business Machines Corp.

"Plastics in Telephone Instruments"—George A. Wahl, Bell Telephone Laboratories, Inc.

Retailing

Presiding: Walter J. A. Connor, American Plastics Corp.

Principal speaker: Philip M. Talbott, President, National Retail Dry Goods Association. *"A Behind-the-Counter View of Plastics"*

S.P.I. Molders' Management Division Meeting

Presiding: Ned H. Porte, General American Transportation Corp.

Principal topic: *"Sound Costing Practice"*—Frank Wallace, Peat, Marwick, Mitchell & Co.

buoyancy, ring buoys, float fillers, and numerous other items. Practically every kind of plastic foam, including silicone, is a possibility for large-scale use in the Navy. When the foams become better known to shipbuilders and designers, their volume use could be in the many millions of pounds.

Sheet Forming Session

The speakers of this session, representing the hardware, heavy electrical appliance, and transportation industries, had this message for the plastics industry: "We can use enormous amounts of formable plastic sheets if you can reduce the costs of material and forming."

The "if" didn't seem so all-important to the aircraft and railroad car makers, since they can save money through the reductions in dead weight and maintenance costs that plastics offer. But for packaging, for refrigerator parts, etc., and for use in autos, cost, particularly material cost, is a primary factor. Even small cuts in price would permit much wider use of sheet plastics in packaging applications.

In heavy appliances, sheet thermoforming will give thinner sections than injection molding, and the cost differential between the two processes (as much as 30%) is, surprisingly, about equal to the cost of material saved. There is a big future in this industry for combined sheets and foams. Present trends toward built-in home appliances are encouraging to the use of thermoformed sheet. By 1965 many millions of homes will have air conditioners and *two* refrigerators, both big users of formed sheet.

Formed sheet has not yet found wide use in autos. Aside from cost, it has been hard to get the desired textures in plastics materials. Roof liners, for example, an excellent prospect for high-volume consumption, should have an "upholstered look." Greater use is foreseen in door panels, flooring, seat side-shields, and molding. Car seats are still assembled by hand; a new type of seat construction might well open the door to extensive use of formed sheet.

In the aircraft industry, formable sheets were originally used in glazing, first made of cellulose nitrate, now of modified acrylics. At present some sheet is going into airplane interiors, where it is a great weight saver; 200 lb. of styrene copolymers go into each Convair-340 plane, in window frames, panels, racks, etc.

With a long history of deficit operation, the railroads are putting on full steam to cut costs, as well as to make their passenger service more attractive. Newest coaches, diners, parlor cars, and Pullmans are full of plastics. The new lightweight trains have methacrylate light panels, polyester window trim, melamine panels, and vinyl trim, tile, and bulkheads. Many more such uses look feasible if forming dies can be made at lower cost for short runs.

General Session

"Plastics usage will grow to astronomical dimensions —if . . ."

That was the consensus of spokesmen for five major end-use industries which in the past have successfully applied plastics materials to their products: automotive, packaging, refrigeration, building, and communications.

And in spelling out that "if" they charted a course which, followed by the plastics industry, must result in its many-fold expansion.

For example, the automotive industry would be delighted to adopt a plastics body . . . if. If the initial cost of the material can come down, if present high production costs can be lowered, if assembly operations can be brought in line with present methods, and if fabricating techniques equivalent to die stamping can be developed.

The packaging field, too, is eager to use more plastics. Retailers have discovered that a plastics package not only protects; it sells. They would like to see more soft goods packaged in plastics film, they would like to see more hard goods sold in vacuum formed containers. They would increase their use of plastics greatly . . . if. If more efficient packaging machinery for flexible clear sheeting could be developed, if the price of the material would come down, and if the plastics industry would furnish better technical service to the end user.

Plastics in building construction have already made their mark. But they can make further contributions. There is a trend toward "organic beauty," toward buildings that are more than enlarged cheese boxes. In the words of the architectural spokesman, "May the plastic age find beauty."

Today, a great number of refrigerator components are made of plastics, but they are still "tiny bits and pieces." The refrigeration industry is looking forward to the day when it will have the equivalent of the "Corvette," that is, a plastics refrigerator body. They are dreaming of a one-piece plastic cabinet that takes full advantage of the insulating qualities of plastics (to replace steel and costly and bulky insulation), that is integrally finished, that will eliminate the numerous hand assembly operations now required. But they are looking for better materials, for lower costs.

The communications industry, which has found in plastics an ideal electrical insulating material, is now concerned with getting materials having specific electrical properties for use in computers, control equipment, etc.

Automotive Session

The total amount of plastics used in the automotive industry will continue to increase as improved materials and techniques introduce favorable economic factors. Reinforced plastics, in particular, are expected to find growing usage, not only for specialized types of bodies and components but also for automotive tooling.

A typical 1955 auto was reported to contain approximately 250 plastics components weighing a total of 10 lb., or about twice the poundage of a 1950 model. A specific 1956 four-door hardtop model cited contains a total of approximately 24 lb. of plastics in various forms, indicating future possibilities.

Printed circuits based on phenolic laminates are expected eventually to supplant the maze of wiring now found behind automotive dashboards. It was also predicted that many die-cast zinc parts will be replaced by chrome-plated phenolic components, with elimination of corrosion and reduction of weight. Premix-type polyester materials will find increased use in engine components as well as body parts.

Formable thermoplastic sheeting, cellulose acetate butyrate, propionate, vinyls in various forms, and molded acrylic and nylon are among other plastics slated for further application development. Polyethylene film is now being used as an inner-door water barrier, while molded polyethylene plugs and fasteners are finding increased use. Elastomeric vinyl weatherstrips for windshields, back lights, and vent windows are another growing application, along with metallized Mylar interior trim. Rigid polyethylene is being evaluated as a steering wheel material.

In restyling the Corvette reinforced plastics body, a change was made from coach-type flanged body joints to channel-reinforced butt joints, eliminating the metal

rivets formerly used. Chevrolet has also done extensive work on reinforced plastics body panels for trucks and is working on development of plastic body solders for field maintenance and possible assembly line use to replace conventional lead-tin alloy solders. On plastic tooling, increasingly important in the auto industry, pressure-cast reinforced polyester dies were said to offer results comparable to other types of plastic tools at lower cost.

Packaging Session

Present-day sociological influences, particularly the rise in national income, the move to suburbia, changes in merchandising techniques, and new concepts of low-cost expendability based on improved plastics materials and automated mass-production processes were pointed to by the speakers on the panel as the underlying causes behind the recent boom of plastics in the lucrative packaging market.

While the over-all cost of many plastics packages is still slightly higher than that of packages based on glass, paper, or other materials, market statistics quoted indicate the willingness of the consumer to pay the extra few cents for all the conveniences offered by the plastic package.

The over-all consensus, however, was that the really big future for plastics—the tens-of-billions-of-units-a-year type of future—lay in the strides being made in reducing this cost differential between plastics and the other materials. The plastics raw materials' price structure has been steadily downward for the past few years, while, at the same time, the price curve of the competitive basic materials, e.g. glass, paper, etc., has been steadily rising. Package designers, in increasing numbers, are also starting to discard the concept of plastics as suitable only for premium-priced packages (justified by their re-use value) in favor of what one speaker described as the "throw-away psychology." Low-cost, thin-wall cups and tomato trays intended only for single-use applications were cited as dramatic examples of this trend.

Material-wise, the new polyethylenes and the even newer polypropylenes, polyester film, saran, the styrene alloys, the new cellulosics, and the vinyls are all being extensively researched for product potential in the packaging field.

When these new concepts in package design and these improved materials are finally put together with automatic, fast-cycling injection molding and vacuum forming machines to turn out plastics packages by the billions and when designers of packaging machinery start to turn out automatic equipment built specifically to handle plastics containers, plastics packaging applications will probably become one of the biggest and most important success stories in the industry.

Building Materials Session

Two impressive indications of the huge future potential market for plastics in building applications are seen in the Monsanto "House of Tomorrow" (see MODERN PLASTICS *33*, 188, Dec. 1955) which is to be built in Disneyland, and in the amazing versatility of the designs entered in the S.P.I. Plastics House Competition. This competition, judged by architects John N. Highland, Jr. and Paul M. Rudolph, and Hiram McCann, editor of MODERN PLASTICS, with James T. Lendrum, of the University of Illinois, as professional advisor, awarded 13 prizes to the most ingenious uses of plastics in the over-all design of small homes. The prize-winning designs were displayed at the 7th National Plastics Exposition.

Most obvious and urgent need in the development of plastics applications in building is education—of the public, of architects, of builders, of the plastics industry itself and, most important, of those responsible for building codes throughout the nation. Some progress was reported on the latter score: both San Francisco and Detroit have recently adopted new building codes containing separate chapters devoted to the use of plastics in building.

From the realm of "blue sky" thinking—plastic roofs with rounded, spiraled, or bonnet forms; new cities of light and color within a hemisphere of transparent plastics; free-form buildings with no waste corners, enclosed in translucent plastics—the Building Session discussion veered to the more practical uses of plastics such as reinforced plastics or vacuum formed sheets to replace forms used in concrete construction; weight-saving sandwich constructions which may reduce foundation requirements; spherical domes already developed for military purposes; and reinforced plastics roofs which can carry wind and snow loads and give the added desirable advantage of translucency.

One unusual application of plastics reported at the session was the use of large acrylic panels and very soft vinyl draperies in auditoriums to improve acoustics. These panels and drapes can be so arranged as to give complete acoustical control.

S.P.I. Annual Meeting

Among activities of the S.P.I. during the past year was a concentrated effort to secure a better position for the plastics industry in the set-up of the FCC rules and regulations covering the use of high-frequency equipment for molding and heat sealing, according to the speaker at the Annual Meeting.

A petition on behalf of the industry has already been filed with the Commission protesting a plan proposed by the Commission in July 1955, requiring re-certification of equipment at periodic intervals. Costs of such re-certification, it was claimed, may easily prove to be more than the equipment is worth.

Another bone of contention is the 890- to 940-mc. band which had been assigned to ISM (industrial, scientific, and medical) users. Heretofore, this band has not been much in use for technological reasons. Now, with the development of a promising new tube which can operate within these band limits and which will cut operating costs, the band is expected to find greater use by ISM users. Prior to the development of the tube, however, certain communications interests have built and operated equipment for this band. These interests are now pleading for re-allocation of this band, while the S.P.I. is petitioning that the FCC confirm its original allocation to ISM users. Until a decision is reached, it is expected that the FCC will forbid the use of the band to communications people.

In the other main order of business at the Annual Meeting luncheon, the officers and directors of S.P.I. elected to serve for the fiscal year June 1956 to June 1957 were named as follows: Director and Chairman of the Board, John J. O'Connell, Pres., Consolidated Molded Products Corp.; Director and Pres., Norman Anderson, Pres., General Molded Products, Inc.; Director and Vice Pres., Alan S. Cole, Exec. Vice Pres., Breskin Publications, Inc.; and Director and Secretary-Treasurer, William C. Bird, Prolon Plastics, Pro-phy-lac-tic Brush Co.

International Reception and Dinner

This event, which grows from year to year, had 310 in attendance; 80 requests for tickets were regretfully denied. Leaders of the plastics industries in Sweden,

Australia, France, West Germany, Holland, Great Britain, Norway, Argentina, and Mexico presented short reviews of present conditions and trends in the plastics industries in their countries. All showed large increases in material consumption in the past year, several up to doubled consumption. Reference was made to the series of articles "Wide World of Plastics" currently running in MODERN PLASTICS Magazine. The Department of Commerce was represented by Geo. A. Fowles, The Society of the Plastics Industry by Norman Anderson, president.

Refrigeration and Air Conditioning Session

The production of vacuum formed inner door liners and other refrigerator components from thermoplastic sheet stocks is now in a transitional stage between an art and a science. One of the most advanced present installations consists of a group of extruders which feed sheet stock to a number of specially built automatic forming units. This set-up will be fully described in an article to appear in the August issue of MODERN PLASTICS Magazine.

The high-impact styrene material, extruded as a sheet 30 in. wide and 0.093 in. thick, is simultaneously laminated to a 1-mil layer of transparent styrene film, imparting a high gloss. The sheets are sheared, stacked, and delivered to the vacuum forming units.

One model refrigerator described includes 27 lb. of plastics, requiring more than one million lb. of material annually. One manufacturer has designed a molded styrene food compartment top that can be used in different models by cutting metal parts to the required lengths. Among other new refrigerator parts is an inner door safety latch having three molded plastic components, including one of phosphorescent styrene which is visible from within when the door is closed. There is a trend toward designing some large injection molded parts so they can be run on machines no larger than 60-oz. capacity, fitted with preplasticator, it sometimes being found most economical to mold super-size parts in sections and assemble them into finished units. A plea for a faster and cheaper method of producing injection dies capable of turning out up to 50,000 parts was voiced by one of the speakers.

With the increased design complexity, larger size, and more severe insulation requirements of today's refrigerators and freezers, some of the plastic foams are beginning to supplant conventional fibrous insulation, which is moisture-permeable, may contain voids or "hot spots," and entails expensive manual installation. Foaming in place, and in some cases the use of plastic sandwich structures, mark two of the most promising solutions to these problems.

Communications Session

The four speakers presented some interesting technical aspects connected with quite different uses of plastics in the communications industry. The chief polymers used in coating wire for telephone lines are vinyl chloride polymers and copolymers, and polyethylene. Insulation colors must be distinguishable on wire after being in service for 15 years or more; the most promising colors seem to be the phthalocyanines and iron oxides, with zinc-coated rutile as a UV screener. Trends are to thinner insulations that permit packing more lines into a given size cable, and, to minimize cross-talk, tolerances on dielectric constant must be held to within 1% of the specified value. The development of super-reliable submarine cable has at last made possible a transatlantic telephone cable. Harder, tougher materials, polyolefins with better crack resistance, and foams will be taking a bigger share of this field.

The realm of encapsulation, impregnation, and dip-coating of electrical components (see M.Pl., April, 1956, pp. 125 ff.) owes its rapid development to the urgency of military applications. The requirements of such applications for high operating temperatures (up to 500° C.) and high rates of heat dissipation by the potting compounds are outstripping the development of these properties in plastics. In a significant reversion of design policy, designers of military electronic gear are finding ways to do without embedding so as to get the needed rates of cooling. For the severe applications, the ideal material would be a foam with high thermal conductivity (!) but good electrical properties, able to withstand high temperatures.

Black telephone handsets are using essentially the same filled phenolic resin they were made of in 1928, but injection-molded butyrate is being used for all housings, and for colored handsets. Some 15 different plastics are now used in telephones, including acrylics, nylon, Mylar, polybutene, polystyrene, and vinyls. Ten years ago only 1% of all telephones were not black. Today instruments are being made at the rate of six million per year, half of them in colors.

Retailing

Plastics can't be sold just because they are plastics; they've got to have something the customer wants. That was the keynote phrase of an experienced retailer in advising plastics producers on how to merchandise their products. Good eye appeal in design, color, finish, and workmanship will be profitless if the product is unsatisfactory, returned, or exchanged. Today is a period of the greatest selling competition the world has ever known. Clerks are not fighting desperately to sell plastics—they have many other products to sell as well.

Informative product labeling takes on increasing importance as more and more department stores turn to self-service operation. But the product and its label must tell the whole story. If it doesn't, the product might as well be part of the store fixtures.

The plastics industry still needs an integrated program to educate store clerks and customers. Knowledge of plastics is still very limited. Customers and clerks still have to be educated on the difference in plastics. They know the difference between iron, nickel, copper, lead, etc. They must be taught the difference between vinyl, polyethylene, acetate, acrylic, and other plastics.

A department store survey disclosed the following: Eighty percent of the buyers replied that their customers do not ask for brand names. Eighty-seven percent said products lived up to manufacturers' claims. Ninety-two percent said sales people and buyers needed more information on plastics. Twenty-three percent said information on how to care for plastics would be helpful in guiding buyers. Only 74% said they knew more about plastics products than they did five years ago. Informative labels are more needed than anything else to help sell more plastics, said 98% of those interviewed; but 65% said present labels do not carry adequate information.

S.P.I. Molders' Management Div. Meeting

Final session of the Conference was a discussion on sound costing practice in the injection molding field in which were brought out the main factors presented in the lead article in this issue of MODERN PLASTICS. Committee reports were given on labor relations, supplier relations, estimating, mold insurance, and sales policies.

The new tester: Molded one-piece housing eliminates shortcomings of metal model at no increase in cost. (Photo, Schladermundt Assoc.)

Molded plastisol battery tester

By switching from metal to vinyl plastisol for its battery tester housing, Socony-Vacuum Mobilgas has been able to offer to its service stations a vastly superior unit at no increase in cost.

The tester that was used up to the time of the change-over had numerous flaws, most of them stemming from the material (painted metal) used in its construction: it would become scratched and rusted after short periods of time; its scratched-up appearance—unavoidable in the course of routine servicing of batteries—looked car-damaging to customers, despite the fact that the tester had rubber legs; it was not resistant to battery acids and the effects of weather; each meter, when assembled, had to be calibrated to its own housing because of the magnetic conditions set up by spot welding of the components, with the result that the entire unit had to be returned to the plant for adjustment each time the meter needed replacing (about every 1½ years); the Mobile logotype was not dramatic and lacked memory-value to convey to the customer the concept of Socony service—which was the purpose behind the development of the tester in the first place; and finally, visibility of the dial, accessibility of the storage compartment, and construction and location of the handle were all unsatisfactory.

Designed for plastics

When the decision to redesign the tester was made, molded vinyl plastisol was finally selected for the housing material because it made possible a product that would (*To page* 200)

The old tester: Metal housing gave rise to many problems in service and appearance. (Photo, Hickok)

Formed of styrene

New concepts in boat construction are inherent in the design of a 5 ft. long skiff for youngsters in which the hull, deck, and cockpit are formed from sheets of high-impact styrene and in which inner chambers are filled with lightweight, buoyant styrene foam.

As a plaything for beach or camp, the small craft offers a number of advantages especially appealing to the younger set. In appearance, it is a scale reproduction of a standard skiff, complete with sleek plank styling; it is extremely light in weight (only 10 lb.); it is durable enough to withstand strenuous play; because the entire deck and hull are formed as single pieces, there are no sharp edges to cut and scratch and no small parts to come loose. To propel the boat, the youngster simply paddles with both hands.

Credits: Pirateer skiff is formed of Bakelite Co.'s high-impact styrene sheet by Plastiform Co., Ypsilanti, Mich.; Styrofoam styrene foam supplied by The Dow Chemical Co.

PLASTICS

Foamed styrene for flower pots

Modern design in plastics has at last brought a revolutionary "new look" to the tradition-bound shape of conventional flower pots—and, at the same time, has overcome many of the difficulties arising from the use of standard terra-cotta clay pots. Molded in one piece of expandable styrene, the stylish "Thermo Planter" is light in weight and almost unbreakable in normal use. Its low water absorption rate and excellent insulation properties cut down on the amount of watering required and maintain nearly ideal soil and temperature conditions within the pot. Consequently, no hole need be provided in the bottom for this purpose.

The streamlined pot is available in white or in pastel shades—making it ideal for potting gift plants.

Credits: Molded by Plasti Industries, Inc., Winona, Minn., using Dylite expandable styrene supplied by Koppers Co., Inc.

Aquarium-table

A rectangular or circular tank aquarium formed of ¼-in. transparent acrylic sheet serves as the supporting column for ultra-modern tables. The rugged table base, which is cemented to the tank unit, is also formed of ¼-in. sheet, but is opaqued with a black lacquer applied to the inside surface. A flat glass top positioned on a set of rubber bumpers embedded in an acrylic rod spacer on top of the tank completes the assembly.

When filled with gravel, water, and plant life and illuminated from a light source located within the base, the aquarium-table provides a highly decorative touch to interior home decor. A retaining acrylic wall at the bottom of the tank holds the sand and gravel in place so that it does not interfere with the light transmission field. Without the base, the remaining unit may be used as an attractive planter.

Credits: Aqua-Tables are fabricated by Modern Plastics, Miami, Fla., using Plexiglas sheet supplied by Rohm & Haas Co.

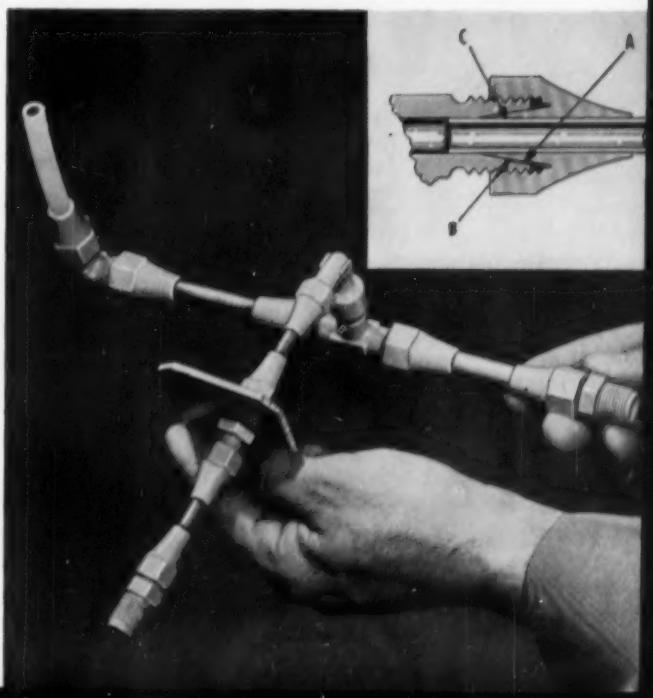
PRODUCTS

Nylon fitting solves joining problems

By molding a new type of fitting of nylon, a positive leakproof and vibrationproof seal can now be effected when joining rigid tubing of any kind. As indicated in the sketch (far right), the taper on the inside of the ferrule nut *A* engages the parallelism taper of the body *B* and compresses against the tube or pipe *C*, giving a positive seal at pressures up to 500 p.s.i.

Weighing only ⅐ as much as brass, having a temperature range from —70 to 295° F., and offering corrosion resistance equal to that of stainless steel, the fitting is easily installed without the use of cement, with no need for flaring of tubing, and no possible stripping of threads. It is guaranteed not to crack or leak under normal conditions. The fitting is available in a complete range of sizes from 1/16 to ½ inch.

Credits: Miracle Fitting molded by Jaco Mfg. Co., Cleveland, Ohio, using Zytel nylon resin supplied by E. I. du Pont de Nemours & Co., Inc.



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Plastics Engineering

Dr. James F. Carley, Engineering Editor

Casting plastics sheets

By John O. Beattie†

Polymerization of liquid monomers or monomer-polymer sirups between glass plates produces plastic sheets of unequaled optical properties. Typical casting resins are made of acrylic esters, styrene, an allyl ester (CR-39), phenol-formaldehyde resins, and copolymers. Detailed procedures are given for casting and curing the monomers and for annealing the sheets. The casting characteristics and sheet properties of the first three materials are discussed in detail and the competitive position of cast sheets is examined.

The casting of plastics materials differs from other molding techniques in that the starting material is a liquid monomer which solidifies by polymerizing within a mold to the finished shape. Casting sheets of most monomers between plates of glass is usually carried out at moderate temperatures and at atmospheric pressure.

There are many different monomers which can thus be cast into sheets. The best known of these is methyl methacrylate, the polymer of which has been sold as cast sheet under the tradenames Lucite and Plexiglas. Styrene monomer can be cast in a similar manner, though production on a commercial scale has been limited. An allyl monomer, diethylene glycol bis-(allyl carbonate), supplied by the Columbia-Southern Chemical Corp. under the trade designation of CR-39, is finding increasing use in cast sheets for welding face-guard plates and lenses as well as sunglass lenses. Vinyl acetate, ethyl and methyl acrylates, acrylonitrile, and a variety of other commercially available monomers may be copolymerized with these materials to modify the sheet properties. In all cases, sheets produced by casting have superior optical properties[1], since their surfaces reproduce exactly the polished surfaces of the glass molds in which they are cast. Other properties, such as tensile and impact strength, surface hardness, and thermal and elec-

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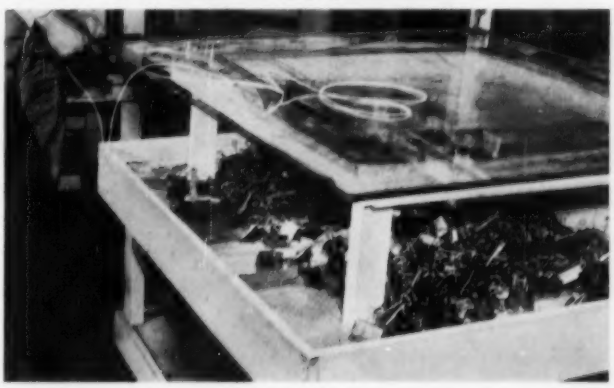
[1]The term "optical properties" is a catch-all which includes such properties as transmittance of visible and ultra-violet light, haze, angular deviation, and minor defects. If the sheet is to be accepted for aircraft applications it must meet the rigorous requirements of MIL-P-5425A. A ¼-in. sheet, for example, must have 90% transmission of visible light but must not transmit more than 5% of incident UV in the 290- to 330-mμ range. Its haze value must be less than 3% and it cannot average more than one minor defect for each 4 sq. ft. A minor defect is a small bubble, a scratch, an imbedded particle. It must not deflect light more than 7 min. of angle from a perfect straight-line path. A 7-min. deflection would cause an object 1 mile distant to appear 10 ft. out of place!

Fig. 1: Operator inserts flexible gasket between glass plates that serve as mold for casting sirup. Softness of gasket allows for shrinkage during polymerization



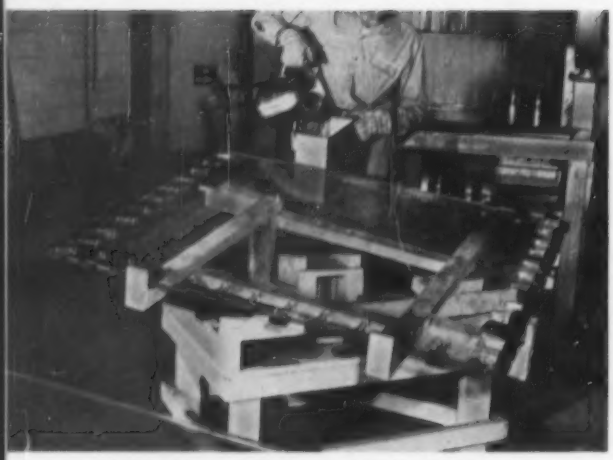
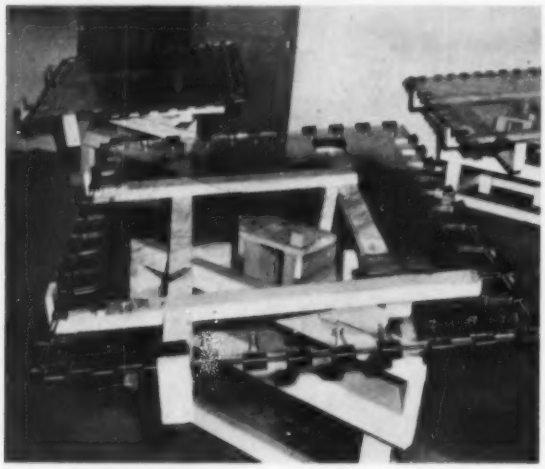


Fig. 2: Accurately weighed-out sirup is poured from stainless steel pitcher into tilted mold through a specially designed funnel

Fig. 3: Charge fills only approximately 60% of the mold volume. The sirup-air interface can be seen running diagonally from top left corner



trical coefficients, compare favorably with those of molded sheets of the same materials.

Casting molds

In preparing a casting mold, two sheets of glass are carefully cleaned to remove all dirt and lint which could create flaws in the finished cast piece. This glass can be selected plate glass, free of scratches and other surface imperfections, or tempered glass (Herculite, Tuf-flex). Tempered glass has the advantage of great strength and resistance to thermal shock, though it is by no means as unbreakable as might be supposed before one has actually handled it.

The two plates of glass, carefully cleaned and dried, are placed face to face and spaced the required distance apart by means of a "gasket" (Fig. 1, p. 109), which can be an extruded elastomeric material such as plasticized PVC, or a solid material such as aluminum or steel covered with paper and cellophane tape (1)[2]. Since, however, all monomers undergo considerable shrinkage as they polymerize, use of solid gasket material requires that the gasket be removed during cure to permit the glass plates to come together and allow for the shrinkage.

The mold, or cell, composed of the two plates of glass separated by the gasket, is then clamped together, with one corner of the mold normally left open for the introduction of the resin monomer. The clamped mold is then laid in an inclined position for filling.

Pouring the resin

The mold is loaded by pouring the resin through a specially designed funnel (Fig. 2) into the corner opening. Since the plates of a glass mold of any size are quite flexible, it is necessary to introduce exactly the correct weight of resin to get a finished sheet of uniform thickness. Figure 3 shows the tilted mold after it has been charged. Filling the mold to the top would cause the glass to bow out under the hydrostatic pressure of the liquid, and would yield a sheet considerably thicker at the center than at the edges.

The mold having been charged, the opening in the gasket is closed and the mold lowered to the horizontal position. The operator taps the mold (Fig. 4) to spread the charge and the mold is transferred to a rack and placed in an oven where the resin is cured (Fig. 5, p. 111). The curing temperature, of course, depends on what resins and catalysts are being used, but in general it is between 45 and 70° C. In many cases a single fixed curing temperature is not satisfactory; if it is necessary to change the temperature during the cycle, a suitable time-temperature control must be installed on the curing oven.

Curing time

The time required to produce a full cure in the mold depends not only on the temperature, but also on the materials and catalysts being used, and on the sheet thickness. All casting polymerization reactions give off exothermic heat; it is just as much the function of the oven to remove this heat as it is for it to provide the temperature required to start the reaction. Casting resins vary widely in the rate at which exotherm is evolved, but it is a good general rule in designing casting ovens to have as high an internal air velocity as possible. If the air velocity is not high enough to remove the heat of reaction, the temperature of the casting will rise. It can easily rise high enough to destroy the sheets being cured; in extreme cases, sufficient thermal shock can occur to shatter the glass molds.

For most materials up to ⅛ in. in thickness, curing time can be held to approximately 16 hours. This is a very convenient length of time: a number of molds can be introduced into the oven at night, say at five o'clock, as the operators are ready to go home,

[2]Numbers in parentheses link to references at end of article, p. 117.

and taken out and cured the next morning at eight. But thicker materials may require more than 16 hr. curing time, since it takes much longer to remove the exothermic heat from a thick piece than from a thin one. In the case of 1-in. and thicker slabs, the curing time may be as much as a week.

After curing is complete, the molds are withdrawn from the oven and cooled, the clips and the gasket are removed, and the glass plates are separated from the now-solid plastic sheet. The plastic surfaces, faithful reproductions of the polished glass surfaces of the mold, are optically clear and ready for use without further processing. Usually the plastic sheets are masked prior to shipment. Masking (Fig. 6, p. 114) consists of applying paper coated with pressure-sensitive adhesive to both sides of the plastic sheet. A sheet so protected can be fabricated without risk of marring the mirror-smooth surfaces.

After the plastic sheets are removed from the molds, the glass plates go back to the cleaning and assembly operations previously described, and the cycle is repeated. The plates of glass can be used hundreds of times if they are properly cared for, and the mold cost per cast sheet is very low.

Shrinkage in the mold

As already mentioned, any mold in which resin monomers are to be polymerized must be designed to allow for the shrinkage which occurs during the cure of the resin. Polymerization shrinkages of most resins are large and must be taken up by allowing the two glass plates to come closer together during the curing process. If they cannot come together, the sheet will separate from the plates and will be spoiled. The magnitude of this problem becomes apparent when the polymerization shrinkage of some of the more common resins used in casting is considered. See Table I, p. 114.

The material naturally seeks to shrink equally in all directions. In the early stages this is possible because the sirup has a relatively low viscosity and flows readily under the stresses set up by volume changes. Later, however, the viscosity becomes very high and at the same time the sheet adheres to the mold plates. Movement in the planes parallel to the plates is severely restricted, so all cast sheets end up with cured-in stresses. These stresses can be alleviated, or at least greatly reduced, by annealing the cast sheet after it is out of the mold (Fig. 7, p. 115). Methyl methacrylate sheets, for example, are normally annealed by reheating to about 150° C. and then cooling slowly. During this procedure the sheets shrink about 2% and the cured-in stresses are almost completely relieved.

Prepolymerization

Another way of reducing the bad effects of shrinkage in the mold is to reduce shrinkage. To this end most thermoplastic resins are prepolymerized to a "casting sirup." Styrene and methyl methacrylate monomers, for example, are clear colorless liquids of about the same viscosity as water. If either of these materials is heated in the presence of catalyst it begins to polymerize, gradually becoming more viscous. If this thickening process is interrupted at the appropriate point, the prepolymer or sirup has about the same consistency as

(*To page* 114)

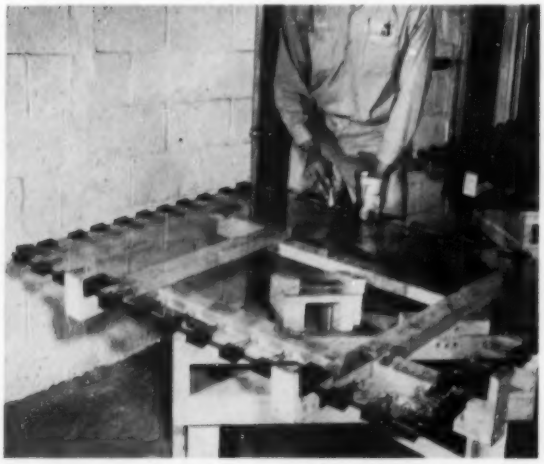


Fig. 4: Operator is lowering tilted mold to the horizontal while tapping it to assure even spread of the charge through the entire mold

Fig. 5: Filled plates are stacked on cart shelves and wheeled into curing oven. The air inside the oven is circulated at high velocity to remove exothermic heat rapidly

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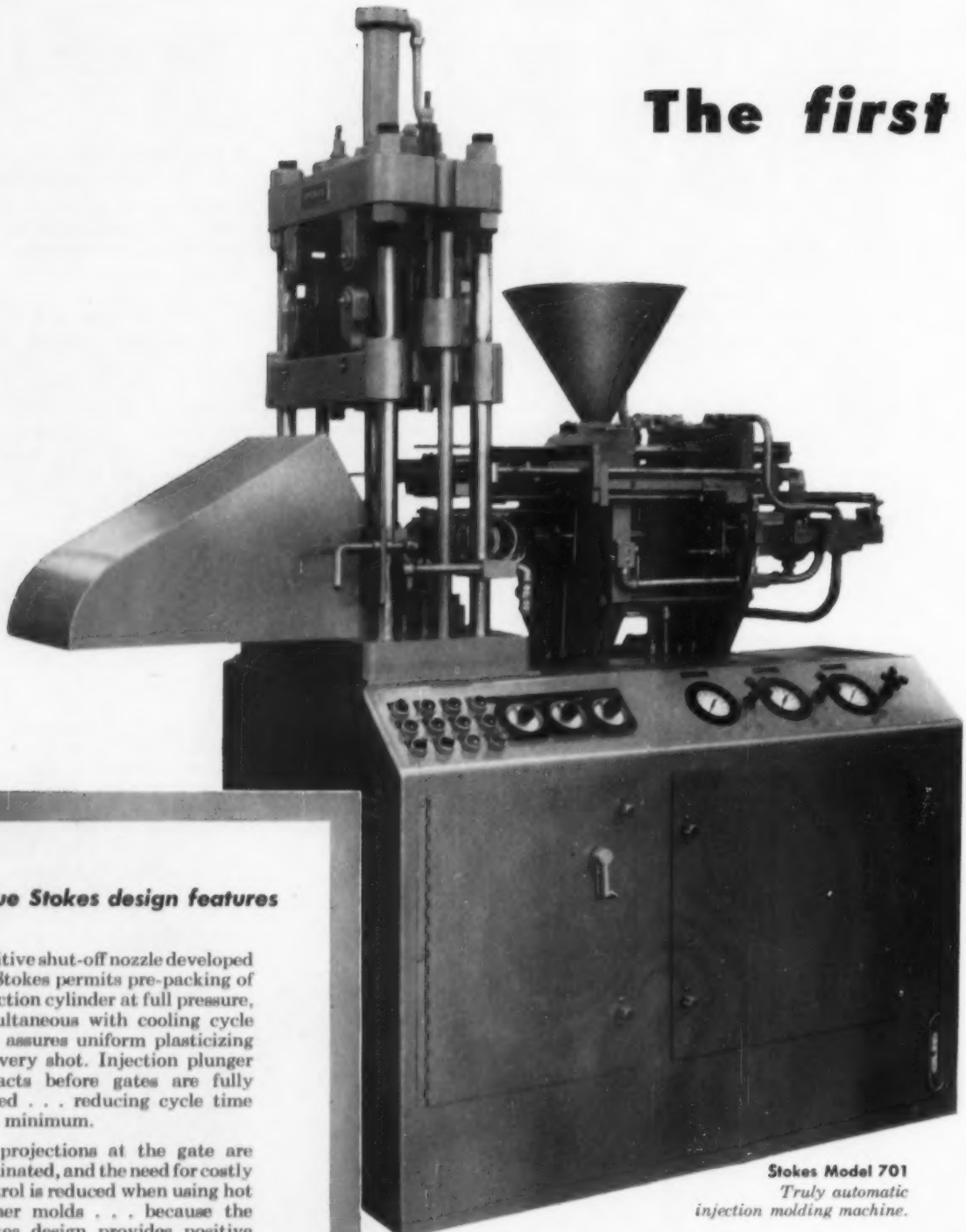

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Fig. 6: Before the sheets are shipped, the surfaces are protected against scratching and other damage by the application of heavy sheets of adhesive-coated paper

molasses (in June, not January!). The use of such a sirup not only lessens the polymerization shrinkage in the mold (because some polymerization shrinkage has already taken place outside of the mold) but also offers three other advantages: 1) the curing time is reduced; 2) less exothermic heat is evolved during the cure; and 3) the sirup is less likely to leak from the mold.

Thermosetting resins cannot be prepolymerized to any useful degree in this manner, since they set up to a firm gel at a relatively low degree of cure.

Rate of exotherm

The resins which are commonly cast differ widely in the manner in which they give off exothermic heat during polymerization. Styrene and CR-39, for example, give off heat at approximately constant rates as the polymerization proceeds. It is therefore relatively easy to remove this heat, and one does not have to be too fussy in designing ovens if these are the only materials to be processed. Methyl methacrylate, however, behaves in a very different manner (2). Figure 8 shows graphs of temperature *vs.* time during cure of a cylindrical methyl methacrylate casting 2 in. in diameter. For the first part of the cycle, virtually no heat is given off. At a crucial stage, the viscous liquid suddenly becomes an undercured solid, and at this point practically all of the heat of polymerization is liberated. An ordinary curing oven which would be satisfactory for the other materials, cannot remove fast enough the big slug of heat which is evolved with almost explosive rapidity. If the sheet is a little too thick for the oven to handle or the catalyst concentration is a little too high, the sudden burst of heat begins to boil the monomer and large bubbles form between the glass plates. The internal pressure mounts fast. When this happens, the would-be manufacturer of acrylic sheet stands by in helpless anguish listening to one after another of his costly glass molds shattering under the effect of thermal shock. Sometimes every last sheet of glass in an entire oven load is destroyed. The resulting product resembles a mixture of cotton candy and molasses, intimately mixed with jagged shards of broken glass averaging about 1 in. in length! Such experiences take a good deal of the joy (and profit) out of the business of sheet casting.

Table I:
Polymerization shrinkage

Monomer	*Shrinkage*
	%
Styrene	17
Methyl methacrylate	21
CR-39	14
Vinyl acetate	22
Acrylonitrile	~26
Ethyl methacrylate	18
n-Butyl methacrylate	15
Phenol-formaldehyde	<0.5
Epoxy	<0.5

Having discussed the general problems of casting plastic sheets, the problems which relate to particular materials will now be considered.

CR-39

The CR-39 monomer is an oily liquid with the following physical properties (3):

Specific gravity @ 20° C. = 1.143
Viscosity @ 25° C. = 15 cp.
Refractive index n_D^{20} = 1.4503
Boiling point @ 2 mm. abs. = 160° C.

The chemical structure of this monomer is:

$$\left[\begin{array}{l} CH_2{-}CHCH_2{-}O{-}CO{-}OCH_2{-}CH_2{-}O{-}CH_2 \\ \hline CH_2{-}O{-}CO{-}O{-}CH_2CH{-}CH_2 \end{array}\right]$$

Since there are two active allyl radicals in the molecule, this material polymerizes to a three-dimensional network, and sheets cast from CR-39 are not thermoplastic.

CR-39 is normally catalyzed with either benzoyl peroxide or with a proprietary catalyst of Columbia-Southern Chemical Corp. diisopropyl peroxy-dicarbonate, commonly called isopropyl percarbonate or IPP. The advantage of IPP over benzoyl peroxide is that it permits curing at temperatures some 25° C. lower. The finished castings, moreover, have better color and better aging characteristics. In practice, 3.0 to 3.3% of catalyst is used. It melts at 8° C. and dissolves readily with stirring in the cold monomer. With benzoyl peroxide, on the other hand, the monomer must be heated to around 70° C. and vigorous stirring is necessary at this temperature to dissolve the catalyst.

The catalyzed monomer is poured into a mold of the type described above, which is then placed in the curing oven. A constant temperature of 48° C. maintained for 72 hr. will cure IPP-catalyzed monomer (25° higher for benzoyl-peroxide-catalyzed monomer). This is followed by a finishing cure out of the mold of 2 hr. at 90° C. In order to shorten the curing time, it is preferable to cure along a cycle in which the temperature increases with time.

Typical cycles (4) are given in Fig. 9, p. 116.

CR-39 can be cured quite readily in ovens which have only moderate heat-absorbing capacity. If, however, an attempt is made to push the cure too fast, the material separates from the mold, resulting in rupture of the curing gel. Cross-linking materials of this type set up to gels very early in their polymerization, and these gels, while elastic to a certain extent, have very little strength. Once the gel ruptures it never rejoins, and the casting is spoiled. At approximately 25% of full cure, CR-39 gel has about the same mechanical properties as the white of a hard-boiled egg, with perhaps even less elasticity. In view of this comparison, it is obvious why undercured castings of this material must be treated as delicately as possible!

Finished cast sheets of CR-39 are optically clear and their surfaces have remarkably high abrasion resistance. The high surface hardness of CR-39 makes it a particularly valuable material for lenses, windows, dials, and specialty products in which scratching of the surface is a problem. Since it is thermosetting, however, CR-39 can be formed only to a limited extent.

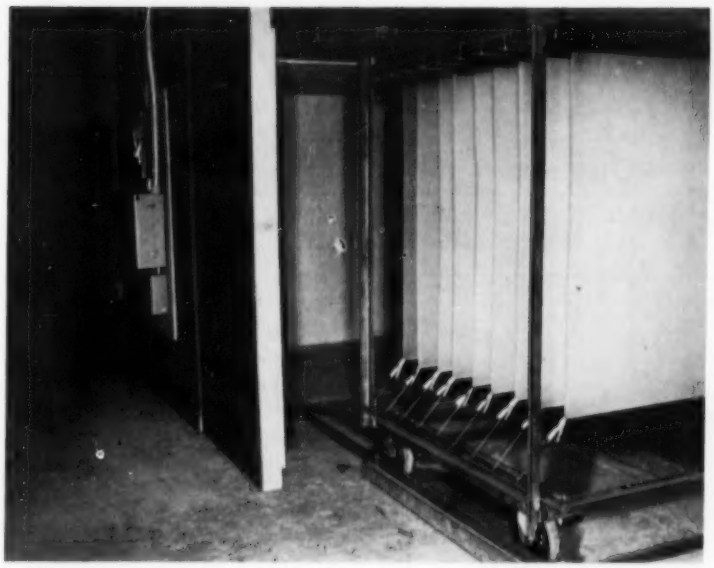


Fig. 7: If cured translucent sheets are to be annealed, they are mounted under slight tension, ready for the oven. Annealing relieves residual stresses while preserving the flatness of the sheet. If not relieved, stresses cause subsequent crazing of the sheet

Styrene

Styrene monomer is a liquid having the following physical properties:

Specific gravity	@ 25° C.	= 0.9019
Viscosity	@ 25° C.	= 0.73 cp.
Refractive index	n_D^{25}	= 1.5439
Boiling point	@ 760 mm.	= 145.2° C.

Since the styrene molecule

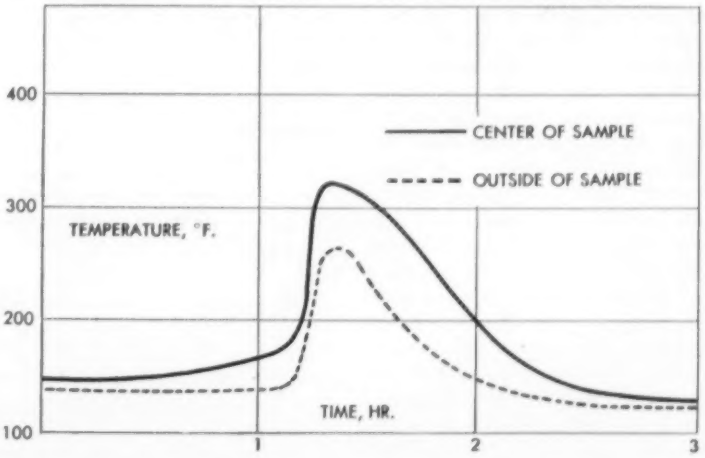
contains only one active group, it polymerizes in linear chains and the cast sheets are therefore thermoplastic.

Styrene monomer, as supplied commercially, contains a few parts per million of tertiary butyl catechol inhibitor. In our work with this material, we have found that it is not necessary to remove the inhibitor. The material is boiled as it comes out of the drum, and it thickens rapidly at 140° C. The boiling sirup must be cooled, else it will boil out of control under the influence of its own heat of polymerization. Such uncontrolled boiling can cause a serious fire.

After the sirup, now the consistency of molasses, has been cooled, catalyst and lubricant are added. Normally, about 1% of stearic acid will lubricate the material and permit separation of the cast sheet from its mold. Benzoyl peroxide or IPP can be used as the catalyst, though recently as non-oxdizing-type catalyst, azo-bis-isobutyric dinitrile, has shown great promise.

The percentage of catalyst used and the curing conditions deter-

Fig. 8: Typical curing-reaction exotherm curves for methyl methacrylate. This particular sample was a 2-in.-diameter cylinder cast in a glass jar immersed in water at 50° C. "Outside" temperature was measured by thermocouple at resin-glass interface. (See Ref. 2)



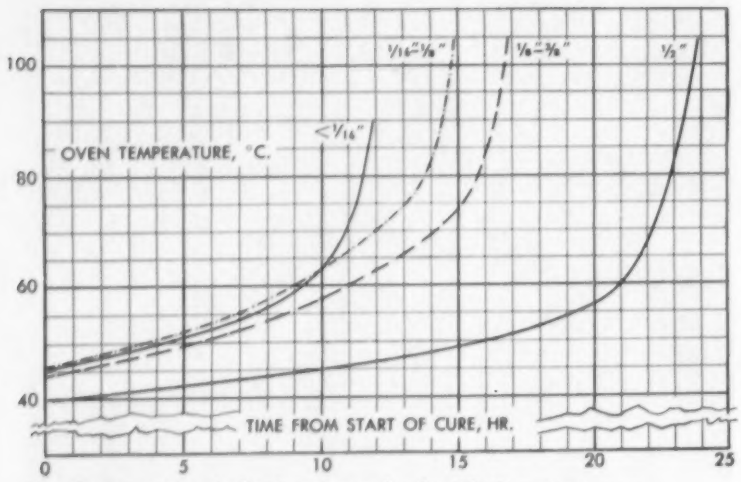


Fig. 9: Somewhat idealized curing cycles for CR-39 casting resins. Spread in curing time is only two-fold. In curing methyl methacrylate, thick sections take many times longer than thin ones

mine the molecular weight, and therefore the properties, of the cast polystyrene. The higher the catalyst concentration and the curing temperature, the lower the molecular weight, and vice versa. On the other hand, if catalyst and temperature are reduced too far, the curing time becomes excessive and it becomes increasingly difficult to produce a cast piece free of bubbles.

At Polycast, we have cast a number of different styrenes with the results shown in Table II, right. We found that the best compromise was to use 0.25% catalyst and a curing cycle of 48 hr. at 50° C., followed by a finishing cure of 4 hr. at 85° C. in the mold. The cured sheets had to be annealed very carefully in order to eliminate subsequent crazing.

Cast polystyrene sheets have excellent optical characteristics, and the material can be readily formed to deep draws and curvatures on standard equipment. In common with molded styrene, however, cast polystyrene sheets are prone to crazing, and its weathering characteristics are relatively poor.

Polystyrene can be cross-linked to yield an infusible, insoluble polymer. The material most commonly used for this purpose is divinyl benzene, in concentrations up to 25 parts per 100 parts of styrene monomer. The resulting sheets are hard, easily machined, and immune to crazing. They retain the excellent electrical and high-frequency properties of styrene itself, and therefore find application in the electronics field. Highly cross-linked polystyrene cannot, however, be formed to any appreciable degree.

Copolymers of intermediate degrees of cross-linking can be made, too, by adding less divinylbenzene to the styrene. It is possible to obtain a sheet of improved craze resistance at only a slight sacrifice in formability by adding, say, 0.5% divinyl benzene.

Methyl methacrylate

Casting-grade methyl methacrylate monomer is a water-white liquid which has the following physical properties (5):

Specific gravity	@ 25° C.	= 0.940
Viscosity	@ 25° C.	= 0.56 cp.
Refractive index	n_D^{25}	= 1.4118
Boiling point	@ 760 mm.	= 100-101°C.

The chemical formula of methyl methacrylate is

$$CH_2=C(CH_3)-C(=O)-OCH_3$$

and since, like styrene, the molecule contains only one active group, methyl methacrylate polymerizes in linear chains to yield thermoplastic sheets.

Of all the materials that can be cast into sheets, methyl methacrylate has the most interesting properties. Cast methyl methacrylate sheets have good tensile and impact strengths and excellent weathering properties. They can be readily machined and on more or less conventional equipment. The material can be formed to almost any simple or compound curvature, and its high optical clarity, luster, and sparkle make this a premium material.

As received from the manufacturer, methyl methacrylate monomer contains 200 to 600 p.p.m. of hydroquinone inhibitor. In order to obtain maximum clarity, it is necessary to remove this inhibitor, and this is usually accomplished by distillation under reduced pressure. Uninhibited methyl methacrylate monomer can be stored for some time if it is refrigerated at around 4° C., but it is best not to accumulate large quantities once the inhibitor is removed.

In casing methyl methacrylate sheets, the first step is to thicken

Table II: Effects of catalyst concentration in styrene casting

Catalyst	*Observations*
%	
1.00	Casting brittle, shattered like glass
0.50	Less brittle; low heat distortion point
0.25	Strong and tough; satisfactory heat distortion
0.12	Long cycle, bubbles, but had excellent properties

the uninhibited monomer to a sirup. At Polycast, we do this in steam-jacketed kettles in batches of about 150 pounds. A small amount of azo catalyst is added to the mix which is then heated to a temperature of 93° C. for approximately 5 min., during which time the material is mechanically agitated. Cooling of the sirup is accomplished by circulating water through the steam jacket of the kettle, and the cooled casting sirup is run into stainless steel containers from which the batches are taken for casting in molds.

The polymerization of methyl methacrylate presents difficulties which are not encountered with CR-39 or styrene. As has been pointed out, most of the exothermic heat of the reaction is given off very suddenly and special care must be taken to remove this heat. Since the amount of heat given off is proportional to the amount of material in the oven, it is the large batches of material and the thicker sheets that are the most difficult to keep under control. Unfortunately, loss of control is most costly when control is hardest to maintain—when the oven is running near its capacity both in molds and in resin. In curing methyl methacrylate, therefore, air velocities and air turnover in the oven must be as high as possible in order to remove quickly the heat that is given off at the critical point of the curing cycle. As an extra safeguard the oven should have an external vent so that cold air can be brought in as needed.

Since water is a much better heat-transfer medium than air, an extra degree of control is gained by curing thicker sheets, say ½ in. or over, in a water bath. It is only necessary to keep the molds in the water bath until the resin has safely passed the critical point. After this, they may be removed and the cure completed in air.

Like styrene, methyl methacrylate can be copolymerized with a number of other monomers. It copolymerizes readily with most of the available acrylate and methacrylate esters, as well as with styrene and vinyl acetate. Copolymerization with cross linking materials such as CR-39, diallyl diglycolate, diallyl maleate, etc., yields infusible polymers with properties intermediate between those of the cast pure resins. Some of these copolymers are valuable commercially because of their increased solvent and craze resistance, though this is obtained at the expense of formability. In some cases, such as the copolymerization of methyl methacrylate with methacrylic anhydride, the problem of exothermic heat is greatly aggravated, so that the difficulty of safely casting some of these materials becomes very great. The temperature-time graph for the curing of a 2-in. cylinder of this copolymer is shown in Fig. 10, above. Note how much higher the temperature peak is than in Fig. 8, p. 115, for methyl methacrylate alone (255° F. in center *vs.* 165° F.). Note also that the slope of the peak in Fig. 10 is steeper—the rate of heat-up is about 1.5 times as fast.

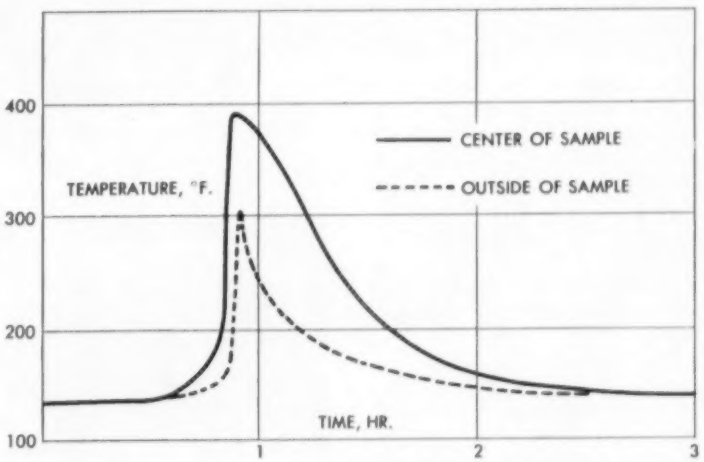


Fig. 10: Temperature-time curves for methyl methacrylate with 10% methacrylic anhydride. Temperature rose much higher than with pure methacrylate (Fig. 8, p. 115), although same conditions obtained. Rate of rise at surge is about twice as fast. (See Ref. 2)

Competitive position

At the present time, cast sheets are competitive in some fields with extruded and compression molded sheets. For some purposes in which good optical properties are required, cast sheets cannot be equalled, and the other types are not competitive. For other applications, such as signs, displays, and vacuum forming, the superior optical qualities of cast sheets are not necessary, and they compete purely on the basis of cost with extruded and compression molded sheets.

Extrusion and compression molding techniques have the advantage of being less costly than casting. However, casting has the advantage of starting from a liquid monomer, which is usually less expensive than the polymer.

In the case of methyl methacrylate, thin extruded sheets are lower in cost than thin cast sheets. On the other hand, because of the difference in price of the polymer and the monomer, thick cast sheets are less expensive than thick extruded sheets. The costs are about even at a thickness of 0.10 inch.

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Simplified drive for injection machines

Hydraulic rams that clamp mold and inject shot are driven by a two-diameter master cylinder with piston geared directly to motor

*By Islyn Thomas**

A new electro - hydraulic drive, which offers advantages in economy and higher ram speed, uses no valves for control of pressure and speed. The mold-closing and injection rams are driven by fluid forced from a third cylinder whose piston is geared directly to the driving motor. Before going into detail, it will be worthwhile to review the requirements of injection-machine drives as well as to summarize the present state of development of hydraulic drives.

The hydraulic system must close and clamp the mold, and must quickly advance the injection ram and inject the shot into the mold, all with proper timing. For molding thin sections—a job that is becoming more and more important with the continuing development of materials with higher stiffness and toughness—it is important that the hot melt be injected as fast as possible.[1] The longer it takes to fill the mold, the more the already injected material cools before flow ceases. High-shear flow of cooled plastic sets up residual stresses in the finished product, leading to loss of strength, warping, and poor control of dimensional tolerances.

Measurements have shown[2,3] that the pressure available in the melt at the nozzle is only half or less than half of that exerted by the plunger. Of course, if the machine has a preplasticator there is no tightly packed bed of feed granules to soak up the available pressure in friction. But it can be expected that for a long time to come there will be many machines made without preplasticators. In spite of the efforts that cylinder designers and material makers will make to reduce the pressure drop in heating cylinders, high ram pressures certainly will be needed for years in the future, along with high ram speeds.

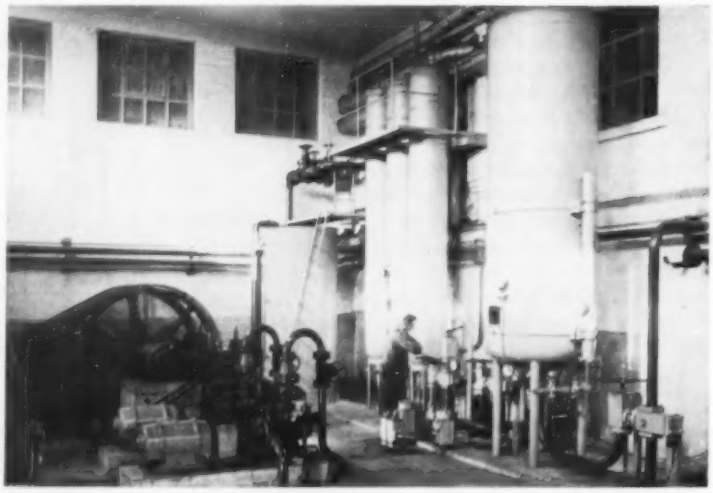


Fig. 1: Large vertical accumulators for hydraulic drive system. Pumps start when pressure in accumulator tanks drops to a predetermined level. (Photo, Werner & Pfleiderer, Stuttgart)

Pumping requirements

In some molds, the runners and gates offer so much resistance to the flow of the melt that the filling rate is determined by the maximum nozzle pressure available. In others, the filling rate is determined by the maximum rate of advance of the ram; i.e., the top pumping rate of the hydraulic system. For this reason, the trend has been toward higher pumping capacities and therefore toward larger pumps. Because a large fraction of the plunger movement can be made against relatively low resistance, and because only low pressure is needed to close the mold, while high pressure is needed for clamping and filling the mold, it is not surprising that dual pumps are used in many machines.

For a typical injection piston making a 5-oz. shot in 2 sec., about 2.6 qt. of hydraulic liquid must be pumped. This corresponds to a pumping rate of 20 gal./min. in the high-pressure

*General Manager, Newark Die Co., 22 Scott St., Newark 2, N. J.

[1] Schmidt, P. E., MODERN PLASTICS *31*, 119 (Nov. 1953).

[2] Gilmore, G. D., and Spencer, R. S., MODERN PLASTICS *27*, 143 (Apr. 1950).

[3] Beyer, C. E., Dahl, R. B., and McKee, R. B., MODERN PLASTICS *32*, 127 (Apr. 1955).

system. Even though the high capacity is required only a small part of the time, the hydraulic system must be big enough to deliver it. A pump of this capacity requires a driving motor of from 40 to 45 horsepower.

To hold down the required pumping capacity, many makers have resorted to some kind of pressure-energy accumulator that will discharge fluid quickly when the high rate is needed. The energy may be stored in any of three ways: by lifting a weight, by compressing air, or by compressing a metal spring. In practice the first method, while satisfactory for other processes, responds slowly and is rather cumbersome. The metal spring accumulator is useful only where limited volumetric capacity is needed, since very large springs are expensive to make.

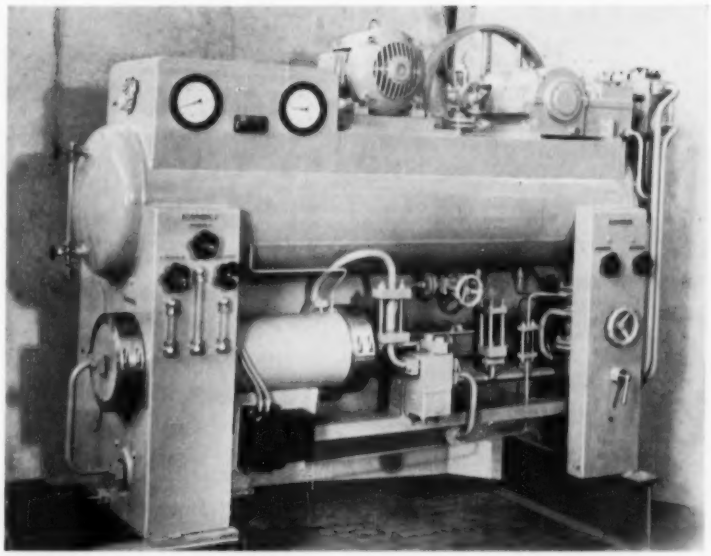


Fig. 2: A compact horizontal accumulator-and-pump system. Large tank at top is precharged with compressed air. Smaller cylinder below has free piston that separates liquid and air

Compressed-air accumulators

Compressed-air accumulators are served by a pump having a pressure-regulated operating cycle. To get the peak rate of 20 gal./min. of the example above, the pump of a hydraulic system with an accumulator would have to deliver at only one-fifth that rate. If the air cushion of the accumulator is large enough, many machine starts and stops may be made without serious fluctuation in the pressure and speed of the injection plunger. Such an accumulator is shown in Fig. 1. The pressure rises in the vertical tanks as energy is stored, falls as it is delivered; the pump starts when the tank pressure drops to a preset level.

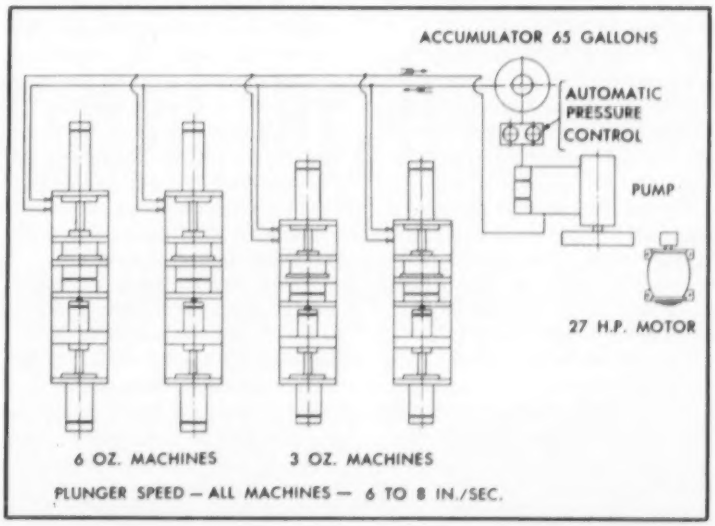
The same idea is the basis of the horizontal-type accumulator shown in Fig. 2. In this hydraulic system the air cushion is separated from the hydraulic fluid by a free piston that moves back and forth in the lower horizontal cylinder. By precharging the air tank at the top with high-pressure air, it is possible to keep the system pressure almost constant as the accumulator goes through its cycle of charge and discharge.

These two accumulators are meant for use with two or more molding machines; a similar type can be integrally built into individual machines, but it is fairly expensive to do this. For the operation of more than three machines, the system should be so designed that extra pumps may be added as capacity requirements grow. A schematic diagram[4] of such a set-up involving four molding machines is shown in Fig. 3. This particular system was used very successfully by Dr. Max Laeis of Eckert and Ziegler in Germany, who found it much more economical of power than individual drives.

The system of Fig. 3 required a pump with a 27-hp. motor; if each of the machines had been equipped with a motor and pump, the total horsepower needed would have been 60. This accu-

[4]Thomas, I., MODERN PLASTICS 28, 94 (Feb. 1951).

Fig. 3: Diagrammatic layout of hydraulic system with accumulator driving four molding machines in tandem. This system has been found to require less power than one using individual drives



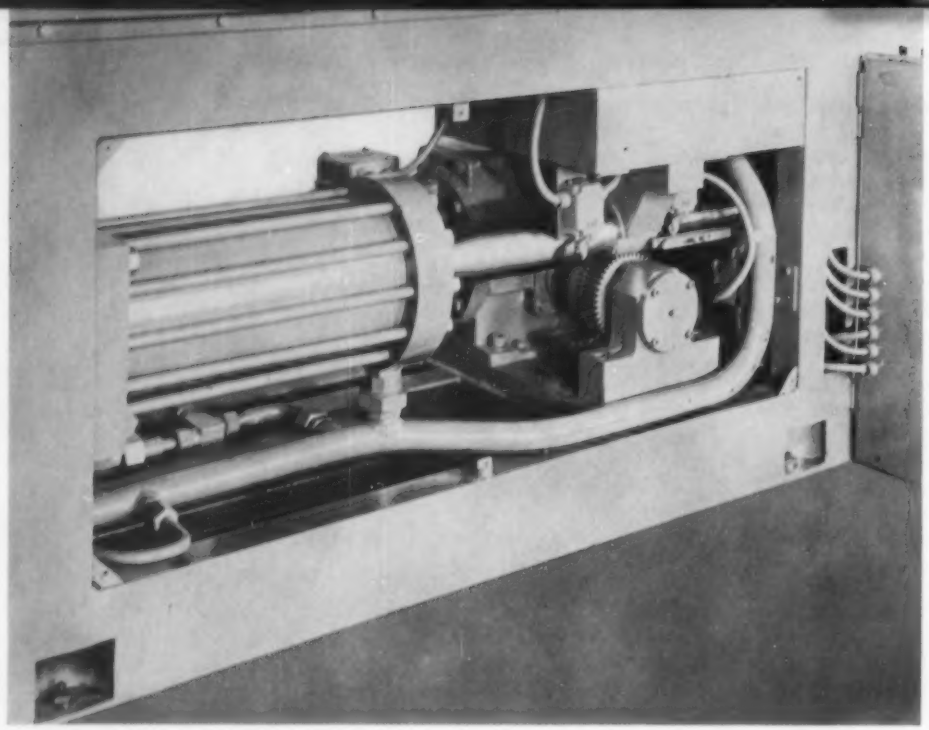


Fig. 4: Close-up of master cylinder with rack-and-pinion arrangement of new electro-hydraulic drive for a ¾-oz. injection molding machine. In this system, the motor runs only when the pistons are in motion, thus avoiding all useless pumping action

mulator is precharged to a pressure of about 1470 p.s.i.; the high-pressure pump then forces "press water" into the accumulator until it is about half full and the air pressure has doubled. An automatic safety valve at the base of the accumulator closes if all the water is forced out.

Pumps without accumulator

Up to now, in the United States, a drive has been preferred which has a pump delivering directly to the pistons without the use of an accumulator. This arrangement offers the advantages of compactness, of placing total responsibility for machine characteristics on the injection machine manufacturer, and of allowing a maximum of independence in operation and scheduling of a number of machines. The pumps used may be of the constant- or variable-delivery types.

Variable-delivery pumps are well adapted to the injection process. High delivery at low pressures is needed for fast closing of the mold and for high ram speed at the start of the injection stroke. At the high-pressure stage, delivery is low and, as was pointed out previously, this is an increasingly important disadvantage in filling thin-section molds.

Constant-delivery pumps require powerful motors if they are to attain the capacities required at certain intervals in the molding cycle. Also, since there is no ram movement during the dwell time, the pump itself must have sufficient slip to protect it against overpressure or else the excess oil must be channeled through relief valves to the reservoir. In either case, a good part of the motor power is spent in heating the oil, and this heat must be removed in an exchanger. Cooling water becomes an added expense of operation, aside from the waste of motor power.

Where two or more machines are to be operated with a single hydraulic system, the pump-with-accumulator system appears to be most economical. For a single machine, a direct oil pump costs less initially but is wasteful of energy. Without an accumulator, the pressure-*vs.*-time diagram of the hydraulic system will show many peaks that could be leveled with an accumulator.

A preplasticator, by splitting the work of injection, reduces the peak pressure needed and so serves one of the functions of an accumulator.

New drive

A new drive for injection machines has recently been announced[5]. Its operating principle is much like that of the hydraulic brake system of an auto: the mold-closing and injection pistons are driven by liquid forced from a "master cylinder" which is really two cylinders in one. The larger is for fast movement at low pressure, while the smaller supplies the final high pressures. The piston of the master cylinder extends outward and gear teeth are cut into its lower surface. This rack engages a pinion driven by a motor especially designed for intermittent, reversing operation with very fast starts and stops. A close-up view of the master cylinder and the rack-

(*To page* 125)

[5]New Machinery and Equipment, Modern Plastics 33, 280 (June 1956).

Molded of vinyl elastomeric plastics, these sandals are soft, resistant to abrasion, have exceptional wearing qualities. They can be held under a faucet to flush off sand and dirt, they dry without cracking or fading. (For details see following page.)

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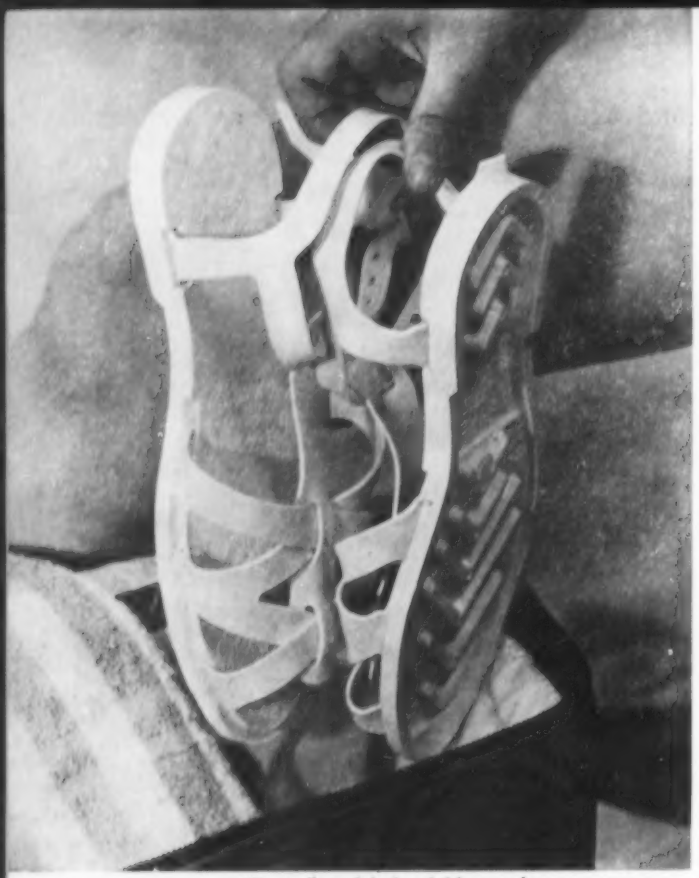


"Rovies" sandals for children and women are manufactured by **Monrovia Plastic Co.**, Monrovia, Calif.

continued from previous page

All-vinyl sandals are long-wearing, good-looking

Both the straps and soles of these sandals are molded of BAKELITE Brand Vinyl Elastomeric Plastics. Even after the roughest use, soap and water will restore their shine. Their integral colors won't wash away. The sandals dry off without cracking, shrinking, or fading. Their flexibility permits complete walking freedom. The straps are securely joined to the soles.

BAKELITE Vinyl Elastomeric Plastics offer several advantages for attractive, long-lived products. Their wide color range is available in transparent, translucent, or opaque effects. Abrasion resistance, flexibility, and durability are among their best-known service properties. Their flexibility can be varied from semi-rigid to soft. Several formulations of these materials are produced to meet a wide variety of applications.

Tough impact styrene for refrigerator breaker strips

Several important features of BAKELITE Brand Impact Styrene TMD-5151 are demonstrated in these refrigerator breaker strips.

This material is outstanding in its toughness . . . will endure the day-in day-out succession of impacts, even at minus 40 deg. F It also provides perfectly reproduced mold details, uniformly matched color with high surface gloss.

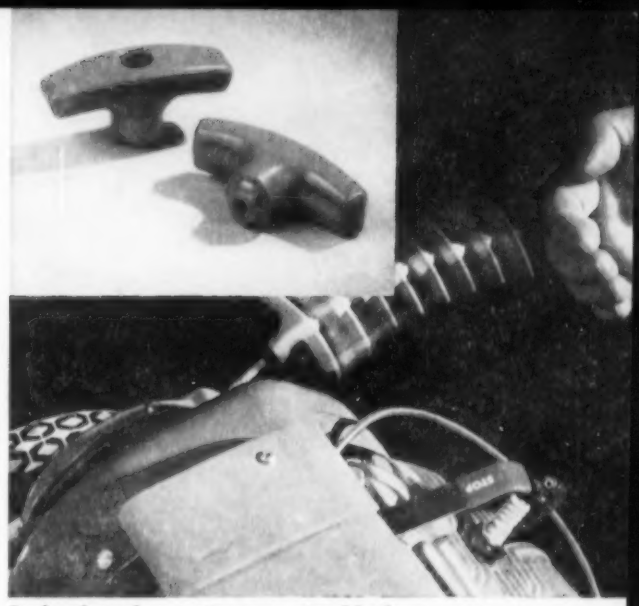
The same qualities of BAKELITE Impact Styrene TMD-5151 proven in this application have made it successful in other product lines. Such examples as air conditioner housings, toys, housewares, and displays give an idea of the variety and scope.

Breaker strips molded of impact styrene are used on door and door frame of refrigerator made by **Hotpoint Co.**, Chicago 44, Ill.

Lawn mower starter handle of elastomeric vinyl

Handles for power lawn mowers take a world of punishment. The use of BAKELITE Brand Vinyl has effectively solved the problem of breakage for the handle of this 1956 model mower and added colorful, attractive appearance as a plus. The resilient vinyl plastic handle assures a good grip, is resistant to perspiration, weather, and oil.

BAKELITE Elastomeric Vinyl Plastics are available in several formulations to cover a wide range of applications. Their flexibility can be varied from semi-rigid to soft. They withstand long flexing without cracking. Transparent, translucent, or opaque effects can be achieved in practically every shade of color, in glossy or matte finish.



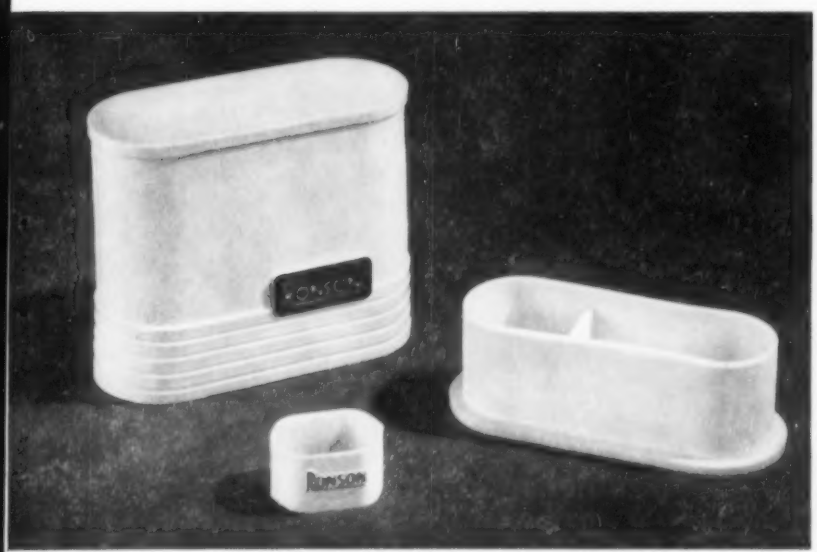
Strobe photo shows action encountered by lawn mower starter handles (inset), produced by **Electric Auto-Lite,** Bay City, Mich., for **The "Reo" Lawn Mower** a product of **Motor Wheel Corp.,** Lansing, Mich.

"Ronson" Shaver Case takes only 7 weeks from idea to distribution

Conceived, designed, tooled, produced, delivered and on the counter in less than seven weeks! That's the story of this case, injection molded of BAKELITE Brand DYNH Polyethylene. Polyethylene provides resistance to impact and shock, giving the razor added protection against breakage.

The top section telescopes over the bottom section and is held in place with a snap fastener on a molded-in tab. Sides of the base are serrated to relieve suction caused by the close fit. The design provides compartmented spaces for the shaver and electric cord. Hot stamping on the raised pad in which the letters are recessed produces the name on the case in contrasting black and ivory.

This is an excellent example of the design, production and service possibilities in BAKELITE Polyethylene.



Electric shaver case molded by **Auburn Button Works, Inc.,** Auburn, N. Y., for **Ronson Electric Shaver Corp.,** Stamford, Conn.

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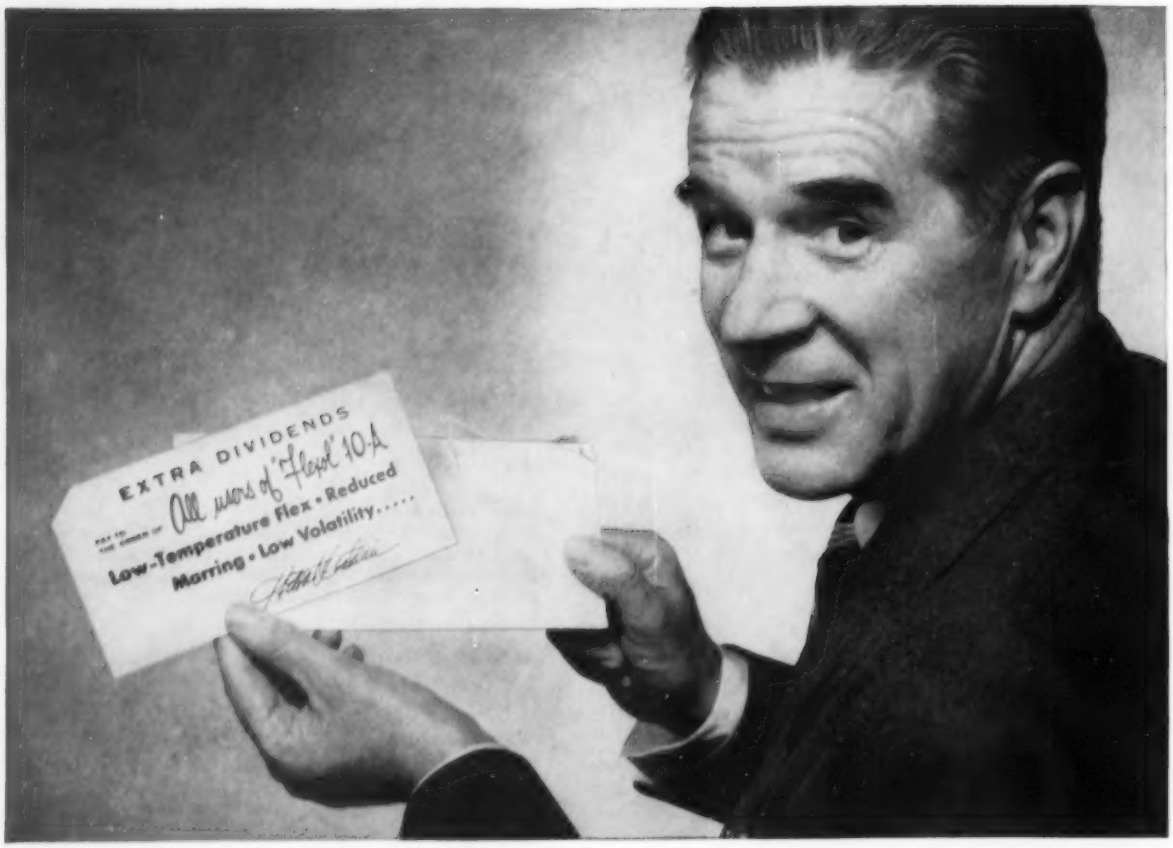

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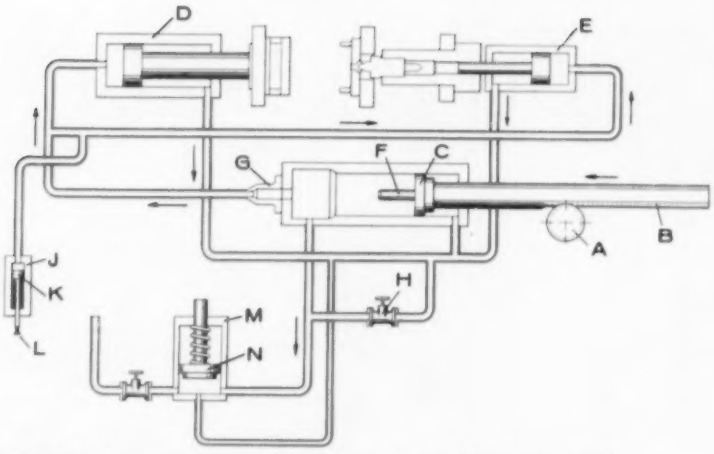


Fig. 5: Schematic diagram of a master-cylinder drive in an operating injection molding machine. The diagram shows the machine in the mold-open position, with the injection ram completely retracted

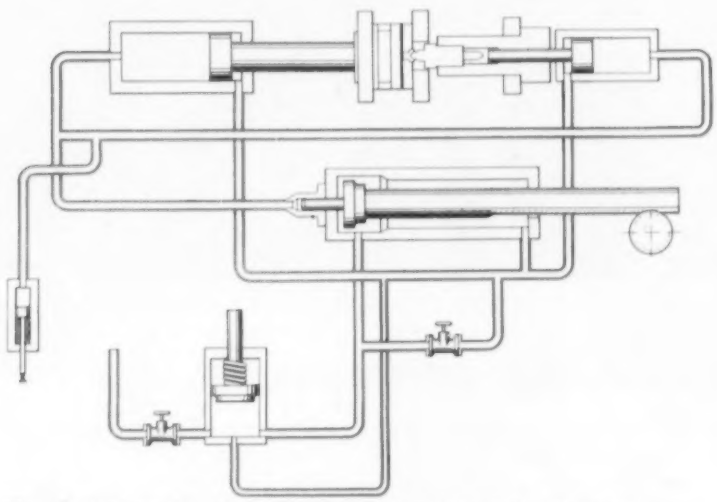


Fig. 6: Diagram of the same master-cylinder drive as in Fig. 5, as it appears at the end of the injection stroke. The hydraulic system is shown in its final high-pressure position

and-pinion arrangement is shown in Fig. 4. In this simple system, very high ram speeds can be achieved and there is no useless pumping since the motor runs only when the pistons are moving. So little heat is generated that the liquid need not be cooled. Control-by-valves is eliminated. An adjustable coil-spring accumulator in the high-pressure line makes it possible to vary the top injection pressure over a 10% range. A thin hydraulic oil, or water mixed with a lubricant, serves as a satisfactory pressure medium.

The intermittent-motor size required is about 4 hp. per oz. of nominal injection machine capacity.

How it works

Figure 5 is a schematic diagram[6] of an injection machine with the master-cylinder drive. In this drawing the injection ram is completely retracted, the mold is open, and the master piston C has been withdrawn into the low-pressure part of the cylinder by the pinion *A* and rack *B*. The motor starts, turning *A* counterclockwise and driving the piston *B* to the left. Liquid at a top pressure of about 210 p.s.i. is forced to flow in the direction of the arrows, and into the mold-closing cylinder *D* and the injection cylinder *E*. As the front face of the master piston *C* enters the enlarged zone of the cylinder, the high-pressure master piston *F* enters the cylinder extension *G*. Meanwhile, excess low-pressure fluid escapes to the right through the large clearance between *C* and the enlarged section of the cylinder. (As in other modern machines, a safety switch stops the motor before the high-pressure stroke begins if the mold fails to close completely.) As the piston *F* advances further, the mold is clamped, the shot is injected, and the adjustable spring of the accumulator *J* is compressed. This accumulator maintains the high pressure after the master piston has stopped in its left-most position. By means of the screw *L*, the top injection pressure (on the face of the ram) can be varied from 14,220 to 15,650 p.s.i. Figure 6 shows the system in the final position.

At the end of the dwell period, the motor starts in the clockwise direction, withdrawing the master piston. Fluid flows in directions *opposite* the arrows, the ram is withdrawn, and the mold opens.

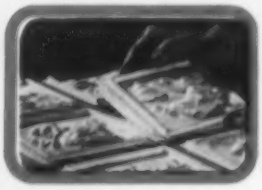
The left side of the driving cylinder is connected to the compensator *M;* by opening the valve *H*, normally closed, the right side of the master cylinder can receive fluid from the compensator. Thus any differences in volume that may arise over long periods of operation may be adjusted. The piston *N* of this compensator is lightly spring-loaded to overcome any frictional resistance.

Elaborations

It is possible, by including quick-acting valves at the proper points, along with corresponding timer parts, to rig this drive for repeated packing strokes before the final injection. It should also be possible, in larger models, to adapt it to driving a preplasticator piston out of phase with the other two. The only model available now is a single-cylinder, single-stroke machine of ¾-oz. nominal capacity.

[6]Thilenius, G. Kunststoffe 44, 143 (Apr. 1954).

Rapid casting of Marblette forming molds begins by pouring the liquid resin into a plaster copy of the original design.



Heat-cured molds, dimensionally exact because of the stability of the Marblette resin, can be interchanged on the press.

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Seasonal and other deadlines are conveniently met when Marblette phenolic molds are utilized for drape and vacuum forming of multiple items with deep draws—providing rapid and accurate mass production of many objects from thermoplastic sheets with preprinted designs.

Applications shown are by courtesy of Majestic Creations, Inc., Woodside, N. Y., and Stanley Wessel and Co., Chicago.

Marblette resins lower costs, step up efficiency of vacuum forming

As the ideal material for quickly and easily made molds, Marblette phenolic casting resins add a profitable plus to vacuum and drape forming. These molds are much lower in cost than machined or cast metal dies, sturdier than plaster or wood molds. Hard, smooth, and light weight, they reduce delays in the production cycle since they do not have to be removed from the press for resurfacing.

The low cost of Marblette phenolic molds, added to their efficiency, makes possible economical mass production with no loss of quality . . . assuring accurate transfer of detail, registration with preprinted sheets, and dimensional stability. For vacuum forming as in many other phases of industrial production, Marblette resins "dependably fit the application."

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Plastics* Technical Section

Dr. Gordon M. Kline, Technical Editor

Plastics—engineering materials

By C. H. Adams†

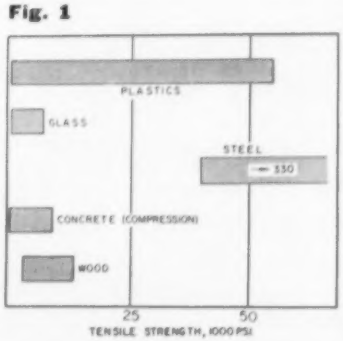
Some read "Plastics—engineering materials" as a statement of fact, others as a question. It is the intent of this presentation to begin with the question and, by examining the characteristics of plastics from the civil engineer's viewpoint, to develop a case for saying that, in fact, plastics *are* engineering materials.

This paper is concerned solely with the engineering characteristics of plastics. It describes their reaction to the various environments of force, time, and temperature. The magnitude of the subject requires a generalized treatment such as would be used in a discussion of the engineering characteristics of metals. The subject will be developed through: 1) a series of comparisons of plastics with the older materials of civil engineering; 2) a series of comparisons of plastics by generic groups; 3) a selected set of quantitative comparisons of plastics with other materials; and finally, 4) an analysis of certain design considerations pertinent to plastics.

Civil engineering

To establish the materials and by inference the properties of interest to the civil engineer, reference was made to the *Encyclopedia Britannica*. The *Britannica*, quoting from the Charter of the Institution of Civil Engineers (London) under date of 1828, has this to say about what *civil engineering* is, "(The) art of directing the great sources of power in nature for the use and convenience of man, as the means of production and traffic in states, both for external and internal trade as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters, and lighthouses and in the art of navigation by artificial power for the purposes of commerce and in the construction and adaptation of machinery and in the drainage of cities and towns." The civil engineer in the early nineteenth century was the only professionally recognized civilian engineer. He operated in many fields, some of which are today considered outside the province of the civil engineer. Today's civil engineer designs and builds heavy, durable structures. These include roads, bridges, dams, canals, and drainage systems for cities and towns. He is concerned then with strength, stiffness, and durability.

Fig. 1



Comparison of materials

The civil engineer in designing and building his roadway, bridge, or other structure uses many different types of materials. Four of these will be compared with plastics as a group of materials to bracket qualitatively the engineering characteristics of plastics. The data presented are on the essentially unoriented form of the material except for wood which is, of course, a directional product of nature.

The short time or so-called static fracture strengths of steel (1)[1], wood (2), concrete (1), and glass (3) are compared with those of plastics (4) in Fig. 1. Data are from tensile tests except those on concrete which are from compression tests. The

Presented at the Dallas, Texas, meeting of the American Society of Civil Engineers, Feb. 17, 1956.
†Research Dept., Plastics Div., Monsanto Chemical Co.

*Reg. U.S. Pat. Off.
[1]Numbers in parentheses link to references at end of article, p. 139.

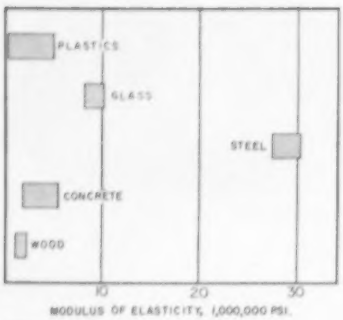


Fig. 2

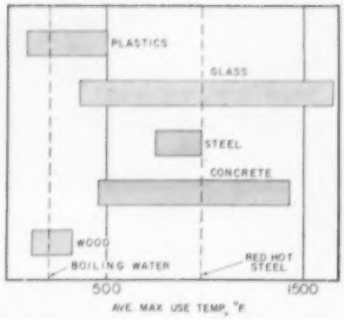


Fig. 3

strength range of plastics materials is broader by far than that of any one of the other materials shown except steel. Depending on the type of plastic composition and the reinforcement used, it is currently possible to cover over a two-hundred fold strength range. Most plastics are lower in strength than steel and the stronger woods. However, certain reinforced compositions approach steel in strength.

The elastic modulus of plastics (Fig. 2) is lower than that of steel and glass. They can be as flexible as low-modulus rubber or as stiff as concrete or wood. The plastics exhibiting the highest modulus of elasticity values, about 1/10 that of steel, are reinforced with fibrous glass.

A comparison of the ductility of plastic materials with that of glass (3), concrete (1), and wood (5) shows that even the most brittle plastics (4) are generally more ductile than these. Their elongation at break in a tensile test measures from less than 1 to greater than 800 percent.

As a class of materials, plastics (4) are lighter than most of the conventional materials (1). Depending on physical form, type of plastic material, and the reinforcing system used, plastics can weigh as little as 2 lb./cu. ft. to greater than 130 lb./cu. ft. The base polymers in solid form cover a much narrower range, from a specific gravity of 0.9 (lighter than water) up to 1½ times as heavy as water.

The useful temperature range of the majority of today's plastics materials (4) is below the wood char point of approximately 380° F. (Fig. 3). Many materials in the thermoplastic (heat softening) group even in non-load bearing uses must be designed to function at less than the boiling point of water. The thermosetting (heat hardening) plastics can be used under the right circumstances at temperatures above the boiling point of water and even up to the wood char point previously mentioned. One or two types of plastics can be used under low load at 500° F.

Flammability is a property of significant importance in the engineering use of plastics. In general, plastics burn in a manner similar to wood. This characteristic can be controlled to a substantial degree by composition modification. In considering whether the burning characteristics of a plastic material present a problem (6), the engineer should carefully weigh the other factors such as light weight, shatter hazard, and softening temperature.

The experience with the use of plastics outdoors is rather limited. However, one plastic material that is satisfactory for outdoor service now has a background of some twenty years' experience behind it (7). Generally speaking, plastics must be protected from the weather either by incorporation of pigments in the material itself or by some type of surface treatment (8).

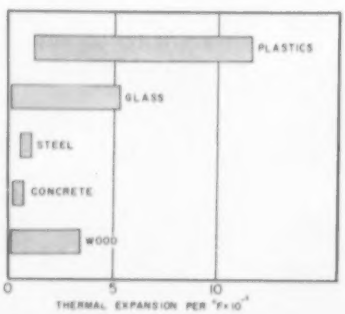


Fig. 4

The change in dimensions of a structure and its components with change in temperature is an important design factor to be considered by the engineer. Figure 4 shows that plastics (4) as a family exhibit a wide range of thermal expansion behavior, much wider than for the other materials (1, 2, 9, 10) charted.

The preceding discussion of plastics as a class of materials has shown that the properties of strength, stiffness, weight, ductility, etc. can all be varied by up to several hundred fold. It has also indicated that the strongest plastic material is roughly comparable to a structural steel and that the weakest has a strength below that of wood. The weather resistance of plastics has been shown to be in need of further study and it has been noted that the maximum use temperature of plastics is generally below that of the materials cited in the comparison. The information presented in this section is felt to be of limited value to the designer. It is presented as an introduction to the general subject of engineering characteristics of plastics.

Generic groups of plastics

Having examined plastics as a class of materials, it is now desirable to explore the various plastics groups and learn to what extent the wide range of properties can be explained by variation in the base plastic. The tags used to identify each group may appear rather formidable, though representing a considerable simplification of the correct chemical name. They are the result of careful study by the industry and represent a compromise between euphony and accuracy in the interest of public acceptance. Before discussing the various properties of the generic groups of plastics, it is necessary again to point out that plastics fall into one or the other of two major types, thermosetting or thermoplastic. Generally speaking, the thermoset materials are more

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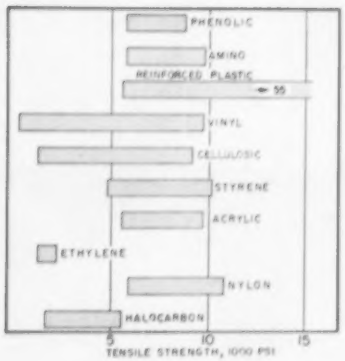

Fig. 5

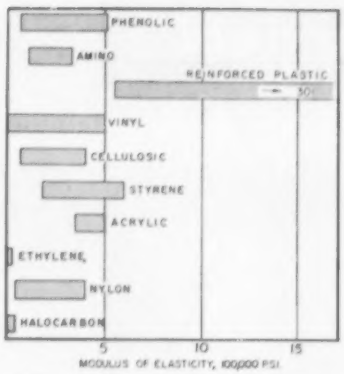

Fig. 6

heat resistant and stronger than the thermoplastics. It is also important to note that the thermoset materials are most widely used in producing what is known to the trade as reinforced plastics. The data charted were, in general, determined by A.S.T.M. tests. The ranges are due to composition or formulation variation. They do not reflect the temperature, time, or other variable effect on a given plastic. These are discussed in the section that follows.

The short-time or static tensile strength (4) of the major types of plastics are compared in Fig. 5. The three materials at the top belong in the thermosetting category. Those below them are thermoplastic. Thermosetting resins combined with fibrous glass give a high-strength reinforced plastic breaking at a stress of 55,000 p.s.i. Thermoplastic resins such as vinyl are weakened by softening agents known as plasticizers.

The stiffness characteristics (4) of plastics are indicated in Fig. 6. As was the case with strength, the highest stiffness is attained through the medium of reinforcement.

The thermosets show a lower order of ductility (4) as measured by elongation at fracture than do the thermoplastic materials. Ethylene and plasticized vinyl plastics show very high orders of extension at fracture, ranging from 300% to a maximum of the order of 700% as compared with a value of 0.5% for a typical phenolic molding material.

The ductility of styrene materials as measured by elongation at break will range from around 1% for unmodified styrene to as high as 35 to 40% in the case of styrene plastic blended with rubber compounds. There are indications that ductility should be estimated from data other than elongation at break in a static test because of the time-dependent nature of the plastic materials, e.g., rigid vinyl if tested at a slow rate of speed will show a high elongation at fracture whereas if tested rapidly will break at something under 1 percent.

Ethylene has the lowest density (4), i.e., is the lowest weight plastic, commercially available today; vinyl is the heaviest. These observations are based on the unmodified plastic. It is possible through foaming to make very lightweight material from most plastics, ranging from a low of 2 lb./cu. ft. upward to the density of the material in a solid form.

The average maximum use temperature data (4) shown in Fig. 7 indicate the general superiority of the thermosetting materials. The most heat-resistant of the unmodified plastics are found in the halocarbon family. Members of this group may be used under no load up to 500° F. As with the other properties, time and load dependence must be recognized in a particular design situation.

The linear thermal expansion characteristics of the members of the plastics family are given in Fig. 8. The thermoplastics as a type change more readily with temperature than do the thermosets. In practice, other things being equal, this has meant that metallic inserts are more readily handled in phenolic and amino moldings than in thermoplastic ones.

Specific engineering data

Having established in broad perspective the relationship of plastics to the established materials of civil engineering and having highlighted the characteristic properties of the several members of the plastics family, a consideration of some specific engineering data is in order.

The stress-strain curve, usually an engineer's introduction to load deformation behavior, provides a very useful picture of the behavior of materials. Figure 9, p. 132, compares the stress-strain behavior as determined in the A.S.T.M. tests of steel (11) and wood (5) with three types of plastics (12). Because of the wide range of load or stress and strain behavior represented, the plot uses logarithmic co-ordinants;

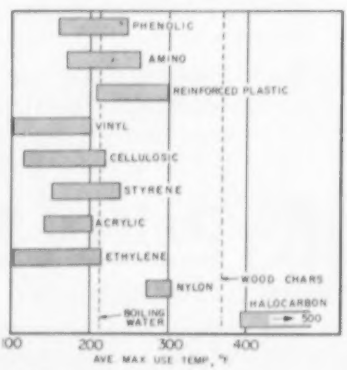

Fig. 7

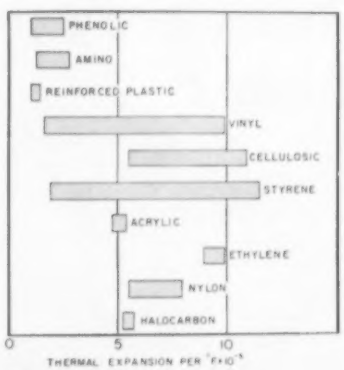

Fig. 8

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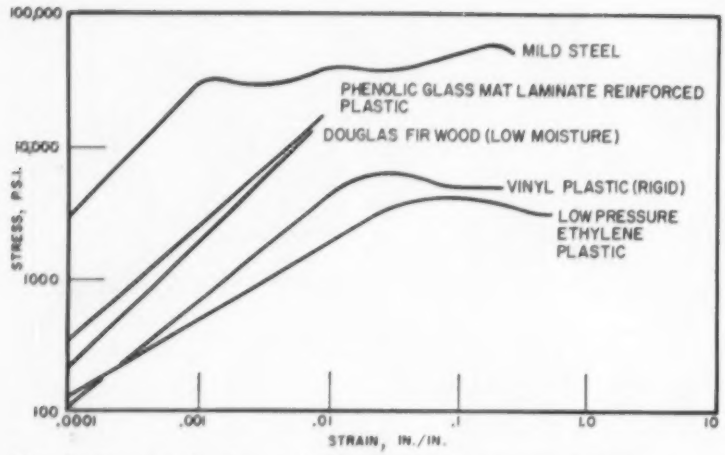

Fig. 9: Stress-strain characteristics at room temperature of three plastics materials, mild steel, and Douglas fir

the curves show the superiority in strength and stiffness of steel over selected members of the plastics family. It points to the similarity in modulus and strength of a common wood used in construction and a laminated plastic material. Lower in the strength and stiffness scale are the vinyl plastic (rigid) and a low pressure ethylene plastic.

Creep data for certain plastics (13, 14, 15) and a typical mild steel (11) are compared in the semi-logarithmic plot of Fig. 10. The common stress, temperature, and loading conditions provide a basis for grading the load carrying ability of the materials shown. It is apparent that to design a part for a structure using any one of these materials, more specific data on creep behavior would be needed. As was the case in previous comparisons of load-deformation behavior, this chart shows that plastic materials must be designed to carry stresses of a fairly low order compared with steel, when creep is the design criterion.

Plastics are finding application in buildings and fluid-handling systems where corrosion resistance is a problem. Figure 11 (4, 16) shows that plastics are generally superior to steel and wood where corrosive liquids and atmospheres exist. The steel cited in this figure is of the ordinary structural variety. It is recognized that alloy types will perform better than the material shown in the chart. A comparison of this nature should always be subject to critical review because of the specific nature of the reaction of chemicals with materials. However, the generalities presented should be helpful in leading the engineer to investigate further a particular plastic type when confronted with a corrosion problem. Certain plastics have found application in pipe lines handling corrosive liquids and have performed better than any other material as far as maintenance is concerned. In addition, the smooth surface of the plastic makes for a lower pressure drop in moving the liquid through the pipe. Glass is an excellent material for resisting chemical attack. Of the four plastics shown, only the halocarbon group is more resistant. However, glass, a heavy, brittle material, frequently requires support and protection in the form of a metallic backing. It tends to complicate jointing and valving problems. Plastics on the other hand are light, offer no shatter hazard, and minimize jointing and valving problems. Though a given plastic type is resistant to a narrower range of chemicals than is glass, this is counterbalanced by the range covered by all types of plastics.

It has been indicated that plastics are more sensitive to temperature than steel or concrete. Figure 12 (2, 17) compares the short-time tensile strength of several plastics with that of steel and wood as a function of temperature. It will be noted that the plastics show a temperature dependence similar to that of wood, though most of the thermoplastic

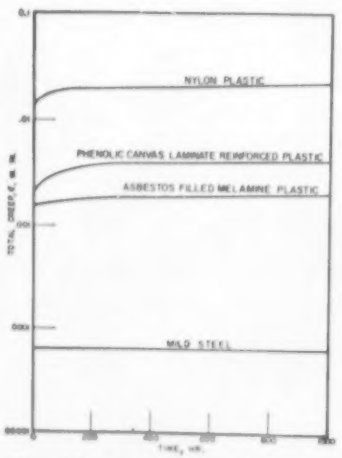

Fig. 10: Creep characteristics of plastics and steel at room temperature and 200 p.s.i. tension

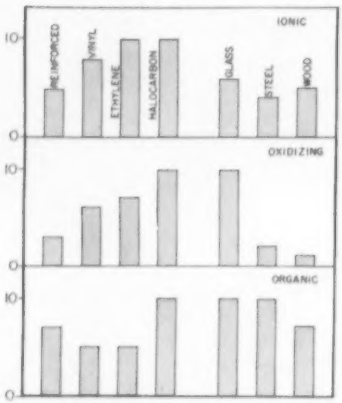

Fig. 11: Average relative chemical resistance ratings

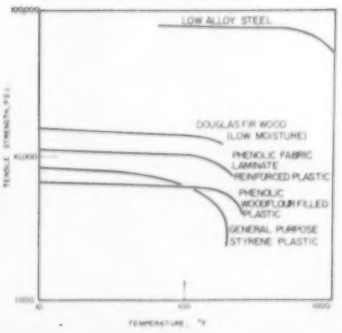
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Fig. 12: Tensile properties of steel, wood, and various plastics *vs.* temperature

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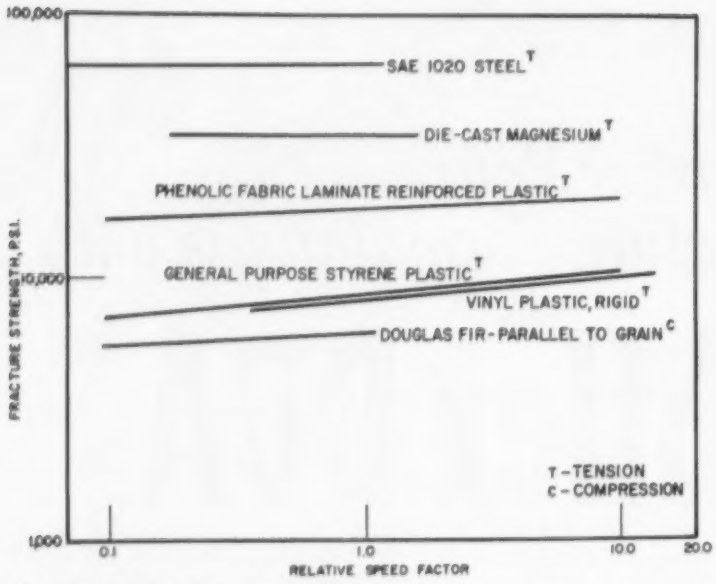

Fig. 13: Effect of testing speed on fracture strength of plastics, metals, wood

materials, styrene being an example, show a more rapid loss of strength with increased temperature than does the Douglas fir. Steel is in a completely different category. It begins to show a substantial decrease in strength at a level approximately 400 degrees above that of the most heat-resistant plastic material. A sizable portion of the research dollar of the plastics industry is being spent in an effort to upgrade the strength characteristics of its materials at elevated temperatures.

The time dependence of plastics has been mentioned and to a degree quantitatively tied down in the figure comparing creep behavior of several materials. Figure 13 shows the effect of testing speed on the fracture strength for steel (18), magnesium (19), wood (20), and three plastics (21). The log-log plot tends to minimize the greater effect of this variable on plastics. Careful examination of the data will show, however, that the metals are relatively speed insensitive in the range covered. Wood shows a time or speed dependency of a nature similar to that of the plastics.

The data shown in the charts have come from many sources indicated in the references. Comprehensive source material on plastics is contained in the Manufacturing Chemists' Association book, "Technical Data on Plastics," the Society of the Plastics Industry's publication, "Plastics Engineering Handbook," the publications of the American Society for Testing Materials, and the various technical and trade journals devoted to materials and their behavior.

Design considerations

Having completed the brief survey of plastics and their characteristics, it seems fitting to consider the question of how to approach the job of designing with plastics in engineering applications.

The matter of fabrication must first be considered since it is important that the engineer have an understanding of how plastics are converted to useful objects and what effect this has on their properties. As the terminology "plastics" indicates, high polymers, which are the base materials from which plastics are made, can be softened by heat and moved by pressure into or through a form of some kind. They subsequently harden either by cooling or due to the advancing of a chemical reaction. The molding operation can take many forms not all of which involve allowing the plastic to become hard in the mold cavity. Certain plastics in the thermoplastic category are formed by extrusion. In this process, the rotation of a screw forces the material through a warm chamber where it softens and finally issues through a die having a fixed shape on to a cooling table. This technique is used to coat wire, to make large sheets, and to manufacture thin film. Sheet material prepared by the extrusion process can be highly directional in terms of physical properties. Thus, anisotropy becomes another factor that the design engineer must be aware of in working with plastics. It is present to varying degree in many items fabricated from plastics regardless of the method of forming. Injection molding is another fabrication technique wherein thermoplastic materials are softened to the semi-fluid state in a heated chamber and forced by a plunger into a cold mold. The rapid cooling of the material leads to a strained condition similar to that in rapidly cooled glass. This strained condition is superimposed on the anisotropy resulting from the flow of the material into the mold. If this strain is at too high a level, the plastic part is subject to failure under thermal shock conditions as well as mechanical. The effect can be minimized by control of molding times, temperatures, and in some instances by postannealing the molded part. Compression and transfer molding, which are used to form thermosetting materials, lead to some anisotropy of a nature usually different from that encountered with thermoplastic materials. In these materials, the directional effect is usually related to the flow forces directionally orienting the filler materials. In the manufacture of reinforced plastics, anisotropy is developed and at the same time controlled by the lay-up of the reinforcing fibers or sheets. This effect is illustrated in Fig. 14 (22) which shows the effect of direction of weave of a reinforcing fabric upon the elastic constants of a plastic sheet.

It has been noted earlier in this paper that plastics are lightweight materials. This has led some to the conclusion that

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plastics are the optimum materials for use in lightweight structures. This inference has been drawn in instances where the strength/weight ratio, i.e., the strength of a plastic divided by its weight, indicates that pound for pound the plastic material will give in some cases a stronger structure then steel. The fallacy of such a concept has been put in its proper perspective by several investigators. The finding of a group of these is shown in Table I, p. 139 (23). In this work, consideration was given to the problem of designing plastics structures for lightweight. It shows that the simple ratio of strength to weight is not satisfactory for predicting the minimum weight of a structure. It, in turn, emphasizes that structures perform many different functions. Some are designed primarily for strength; some, rigidity or stiffness; and some to damp vibrations. Depending on the particular design consideration superimposed on the main objective of a lightweight structure, a material heavier than a plastic may be used. Given the choices of type of loading and geometrical configuration of the structural member, the use of plastics in flexure as sandwich panels is favored. The sandwich panel design is based on the same principles of mechanics as the very familiar and widely used structural component, the "I" beam. In effect, the sandwich panel is an "I" beam with a very light web and high strength flanges. The web or core of a sandwich panel is made of a low density foamed plastic or from honeycombs of aluminum or plastic impregnated paper bonded with phenolic or other resinous adhesives. The flange or face is made of reinforced plastic, metal, or other material. This is bonded to the core with a plastic adhesive. This illustrates the important point that plastics in combination with other materials and in various forms give the engineer a new degree of design freedom.

The use of plastics as light transmitting materials in aircraft, automotive, and construction applications was pioneered by Henry Ford in his Model T. The reasons for using plastic in the T's side curtains were, no doubt, largely economic and its use was not subjected to critical engineering analysis. However, with the development of the acrylic aircraft canopy prior to and during World War II, plastics entered the light transmitting field for engineering reasons: e.g., the plastic was lighter than materials conventionally used, readily formed into complex shapes, and free of the shatter hazard of conventional glazing materials. The plastic allowed the aircraft designers considerable freedom and made possible a clean aerodynamic shape. Safety glass is made safe by virtue of a plastic interlayer between the glass surfaces. This contribution of plastics to safety began in the late twenties with the use of a cellulosic sheet which yellowed quickly and did not bond the glass faces too well. Continued research has led to improved vinyl-type plastic interlayers. Panels of safety glass made with this type of plastic, exposed outdoors for periods in excess of ten years, show almost no color change and continued excellent adhesion to the glass faces. The use of plastic materials *per se* as automotive glazing materials is limited to the rear lights in convertibles because of the poor to fair scratch resistance of most plastics. The convertible rear light has given the automotive designer more freedom than he had with glass sewed into the canvas back and at the same time improved the safety factor of convertibles by introducing a lightweight flexible material that is completely free of the shatter hazard.

Other areas with which the engineer must deal are fluid flow

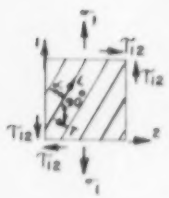
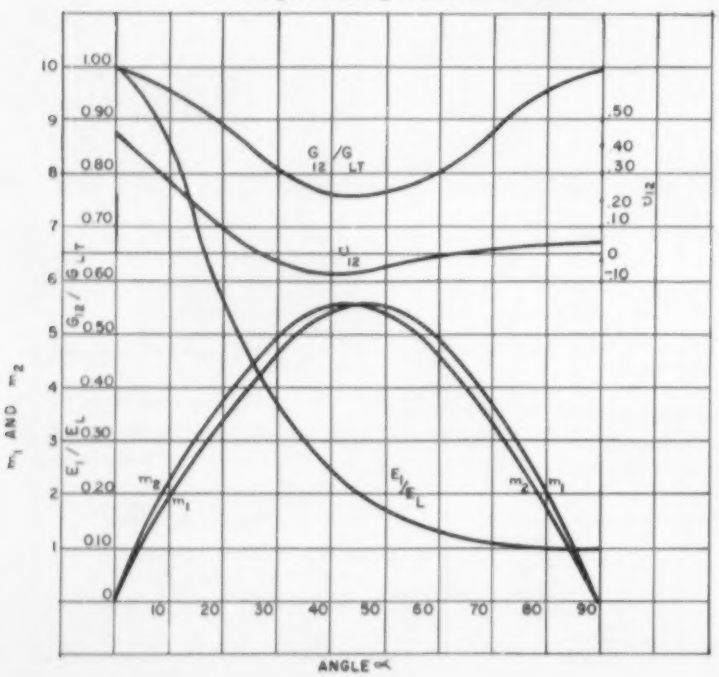


Fig. 14: Effect of direction of weave upon elastic constants of reinforced plastics and laminates. Legend: $E_{1,}$ = elastic modulus in longitudinal direction; E_1 = elastic modulus at angle; G_{12} = shear modulus associated with angle between direction of stress and longitudinal axis; $G_{1,T}$ = shear modulus associated with longitudinal and transverse directions; σ = tensile stress; τ = shear stress; α = angle to longitudinal direction; m = distortion factor, accounts for tensile and shear strains; $—_{1,2}$ = subscripts referring to directional notation



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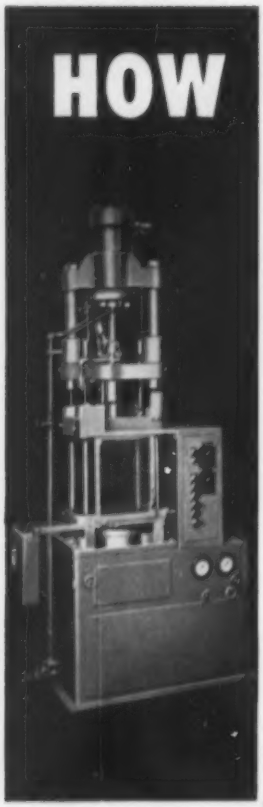

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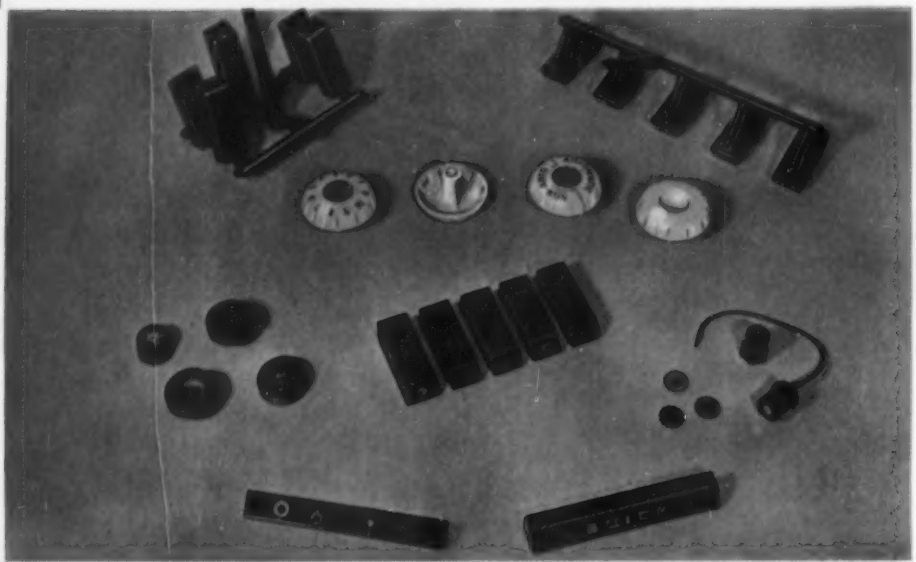

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WS-16

Table I: Comparison of weights of structures made of different materials[a]

Functional specification	Criterion for minimum weight[b]	Order of increasing weight of structure						
		SAE X4130 steel	Titanium alloy	75S-T aluminum alloy	Paper laminate, phenolic	Cast phenolic	Tough styrene	Crystal styrene
A. Strength								
1. Axial load	γ/σ	4 (2.83)	1 (1)	2 (1.12)	3 (1.81)	6 (5.12)	7 (9.18)	5 (4.68)
2. Bending of simple rectangular beam								
a. Width specified	$\gamma/\sigma^{1/2}$	7 (2.94)	3 (1.33)	2 (1.11)	1 (1)	5 (1.63)	6 (1.97)	4 (1.39)
b. Depth specified	γ/σ	4 (2.83)	1 (1)	2 (1.12)	3 (1.81)	6 (5.12)	7 (9.18)	5 (4.68)
3. Torsion of circular shaft	$\gamma/\tau^{2/3}$	5 (2.62)	—	1 (1)	4 (2.04)	3 (1.39)	—	2 (1.20)
B. Stiffness								
1. Axial load	γ/E	1 (1)	3 (1.08)	2 (1.04)	4 (2.25)	5 (7.17)	7 (10.6)	6 (10.1)
2. Bending of simple rectangular beam								
a. Width specified	$\gamma/E^{1/3}$	7 (2.40)	6 (1.70)	2 (1.22)	1 (1)	5 (1.41)	4 (1.40)	3 (1.35)
b. Depth specified	γ/E	1 (1)	3 (1.08)	2 (1.04)	4 (2.25)	5 (7.17)	7 (10.6)	6 (10.1)
3. Torsion of circular shaft	$\gamma/G^{1/2}$	5 (1.65)	— (1.30)	1 (1)	5 (1.66)	6 (1.77)	7 (2.24)	3 (1.62)
C. Resistance to impact Bending of simple rectangular beam	$\gamma E/\sigma^2$	7 (8.60)	1 (1)	2 (1.30)	3 (1.57)	5 (3.93)	6 (8.53)	4 (2.33)
D. Resistance to resonant vibration Axial load	$\gamma/CE\sigma^{n-1}$	2 (22.0)	— —	— —	1 (1)	4 (75.0)	5 (120.9)	3 (73.2)

[a]Numbers in parentheses give relative weight of structure for material concerned in terms of weight of lightest structure.
[b]Code for symbols:
γ = Specific weight in lb./in.^{3}
σ = Tensile yield stress in p.s.i.
τ = Ultimate shear stress in p.s.i.
E = Young's modulus in p.s.i.
G = Shear modulus of elasticity in p.s.i.
C = Stress coefficient of damping capacity in p.s.i.$^{1-n}$
n = An empirical dimensionless number

machinery, building components, machine components, electrical power transmission equipment, etc. It is hoped that the properties data and engineering analysis of the behavior of plastics presented herein will prove helpful to the civil engineer when faced with a material selection problem in one or more of his many fields of endeavor.

Plastics are engineering materials

In the introduction the question was posed, "Are plastics engineering materials?" The data presented indicate that plastics have many useful properties which warrant their consideration as engineering materials. Among their useful characteristics are ease of fabrication, light weight, adaptability to combination with other materials to achieve new structural effects, and the ability to vary many of their properties over a wide range to suit the needs of a specific application.

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(*To page* 201)

Asbestos reinforcements

*By D. V. Rosato**

Asbestos reinforcements are available in a variety of forms such as felts, mats, papers, asbestos-phenolic molding compounds, prepared asbestos fibers, and cloth and yarn which provide unique properties including stiffness, heat resistance, chemical resistance, and insulation. These forms make asbestos available to industry for a variety of molded and laminated products which include shapes from relatively flat to complex contours for both structural and nonstructural parts.

Of the several types of asbestos, chrysotile, a hydrated silicate of magnesium, is superior to all other varieties for general industrial purposes and accounts for about 95% of the world's production. Chrysotile is found in veins in the base serpentine rock. Mechanical methods are used to separate the asbestos veins from the rock and in turn separate the individual asbestos fibers. The most extensive chrysotile asbestos mines are located in Canada and South Africa. These mines are currently the principal sources of asbestos used in the United States.

Chrysotile asbestos fibers are the thinnest and softest inorganic fibers known (1/50 of a micron or approximately $1/1500$ the diameter of an average human hair). These mineral fibers are unique in that they are always the same diameter and have a circular cross section.

*Chief engineer, Reinforced Plastics Dept., Raybestos-Manhattan, Inc.

History of development

Asbestos has been one of the engineer's important materials as a plastic reinforcement and filler since the development of resins. It contributes the following advantages: 1) heat and flame resistance, 2) chemical and water resistance, 3) decreased mold shrinkage, 4) low-cost filler, 5) improved dimensional stability, 6) elimination of or reduced surface crazing of resins, 7) resistance to creep, 8) electrical properties, 9) controlled plasticity of resins, 10) frictional properties, 11) vibration and sound absorption, and 12) thermal insulation.

Research and development programs have been in progress to further advance the use of asbestos with plastics. The main interest has been to promote the use of various styles of continuous sheet material. Asbestos fabrics have been in use for many decades, primarily in combination with phenolic resins for electrical applications such as slot wedges, armature insulators, and the like.

More recently a new version of a continuous asbestos sheet material for reinforcing became available to industry. In 1940 high-strength Pyrotex felts were introduced and have since been used by practically every high-pressure laminator as a standard base material. Pyrotex products are made by mechanically opening mined fibers and processing them through carding machines.

In England there appeared in approximately 1945 another variation of asbestos felt which is called Durestos. It is a phenolic resin-impregnated material which has found varied applications in England.

Since 1940, in order to appeal to the wire and cable, reinforced plastics, electrical, and filtration industries, several asbestos-base papers have been developed, notably Quinterra and Terratex. Several years ago, Novabestos papers were developed; in these, the quality of asbestos paper is improved by "opening" the fibrous bundles and thereby re-

Table I: Description of Pyrotex felts[a]

Pyrotex Style	*9526*	*9343*	*9524*	*9372*	*9394*	*9517*
Grade of asbestos fiber	Extra long	Long	Long[b]	Blend of longs	Long and medium	Medium and short
Composition, by wt.						
Asbestos (min.), %	99	85	85	85	85	80
Organic (max), %	1	15	15	15	15	20
Thickness, mil (± 10%)[c]	10	8 and 10	10 and 15	8 and 10	10	10
Weight/1000 sq. ft., lb. (± 5%)	22	14.5 and 17.0	21.0 and 31.5	14.5 and 17.0	17.0	17.0

[a]Felts also available with NS, RB1, and RB3 treatments.
[b]Contains glass cloth, 50 and 33% nominal of total weight for 10- and 15-mil styles, respectively.
[c]Based on the average ply of a measured stack height of 10 plies, using micrometer with 5/8-in. diameter head with 300-g. head weight.

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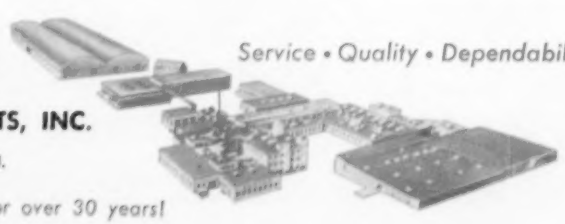

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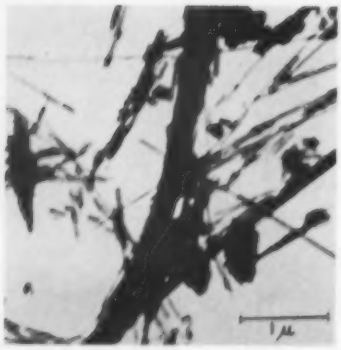

Fig. 1: Electron micrograph of chrysotile asbestos (not chemically open)

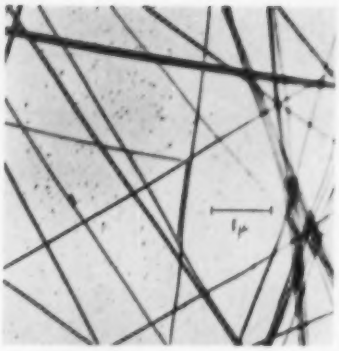

Fig. 2: Electron micrograph of chrysotile asbestos (chemically open)

moving undesirable entrapped magnetite.

Since February 1955, there have been intensive studies conducted in government and industrial laboratories of the inherent benefits of Pyrotex felts and Novabestos papers to the general reinforced plastics field.

Chemistry and manufacture

Pyrotex felts: The mechanically opened asbestos fibers are processed through carding machines which arrange the fibers in a tenuous web. Pyrotex felts are currently manufactured in various styles (see Table I, p. 140), all of which are made from spinning-grade fibers. Style 9526 has the highest degree of strength and contains practically no organic matter. Style 9524 contains an open-weave glass cloth. Bulk factor of the felts when impregnated with resin is approximately 3:1 when cured at 200 p.s.i. Other styles are also available with varying percentages of carrier fiber. All styles are supplied with or without various resin binders which are suitable for phenolic or polyester resin applications. Felts are also suitable for epoxy, melamine, and silicone impregnation.

Various thick mats have also been developed and are available with or without laminating resins. Typical is a Pyrotex mat that contains phenolic laminating resin and ranges in thickness from 20 to 100 mils for uncured sheets. Bulk factor of the mats is approximately 3:2 when cured at 200 p.s.i. Two layers of 80-mil mat will press to approximately ⅛ in. thick. Prepreg such as Pyrotex felt Style 9526D2 (8 oz./sq. ft.) makes available parallel laminates with tensile and flexular moduli of elasticity of 5 to 5½ million p.s.i.

Novabestos papers: A unique form of asbestos, Novabestos papers are the result of a chemical process which produces dispersed, single, long-fiber asbestos (see Figs. 1 and 2). Products made with this material have an extremely fine, smooth, uniform, flexible, and long fibrous structure. Because of the fineness of the fibers, these dispersions are colloidal and special solutions are necessary to handle them.

Novabestos papers are available (Table II, below) as either an all-asbestos composition or in combination with various proportions of fibrous glass, approximately ½ in. in length. They contain no organic fibers. Their organic content consists of residual, absorbed, oxidized, organic acid derivatives on the asbestos fibers and/or on the resin coupling agent on the glass fiber. This organic matter can be removed, if desired, by heat-cleaning or through the use of suitable solvents; however, the amount of organic matter present does not interfere with properties.

The Novabestos papers contain long-fiber asbestos when compared to standard asbestos papers. The latter are generally made of extremely short-fiber asbestos which are not dispersed and contain a high percentage of impurities. Because single fibers can be dispersed, impurities common to asbestos can be readily removed. The extremely fine, single, and chemically dispersed fibers provide better packing properties than do standard-fiber compositions. This becomes evident from the easy formability of resin-impregnated Novabestos papers.

Novabestos papers are available in either a soft or stiff form and with various paper treatments. Novabestos papers should be considered wherever the relatively coarse pattern and structure of other asbestos fiber materials have been found undesirable. They may be used alone or combined with other reinforcements for surfacing or interleaving in laminates and are compatible with all standard laminating resins. Papers containing fibrous glass provide a thicker material which will absorb resins more readily.

Processing methods

Standard techniques can be used for fabricating asbestos-reinforced plastics using felts, mats,

Table II: Description of Novabestos papers*

Novabestos style	*7401*	*7403*	*7410*	*7411*	*7412*
Composition, by wt.					
Asbestos, %	90–92	75–80	55–60	30–35	15–20
Glass fibers, %	0	15–20	35–40	60–65	75–80
Organic, %	8–10	4–6	3–5	3–5	2–4
Thickness, mils	*Approx. lb. per 100 sq. yd.*				
2.5	4.0				
5	8.8	10.0	8.3	7.0	
7		15.0	11.0	9.9	
10			15.9	14.8	13.5
15				22.3	20.1
20					23.1
25					28.5

*Papers are available with various treatments.

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or papers. The felts can very readily be handled in wet lay-ups or dry lay-ups. Felts containing no resin binder can be wet with resins very readily; however, they are not satisfactory for handling in large, unsupported sheets. Felts are also available with various resin binders, including polyester and phenolic types, which provide excellent wet strengths for polyester and phenolic laminating resins. At the present time, epoxide resins are being evaluated with felts containing no binder and also with felts containing resin binders. Limited data indicate that asbestos-epoxide resin laminates produce the usual high strength and, in addition, high modulus of elasticity values.

The fine structure characteristics of the papers require that adequate precaution be taken to obtain full saturation and elimination of air in order to obtain best properties. Techniques such as squeeze rolls or vacuum impregnation are highly desirable. When hand-impregnating, it is most important to "handwork" products to insure proper saturation in order to obtain void-free laminates.

The ability of the felts and papers to wet satisfactorily with resins and retain wet strength can be illustrated by the fact that they can be used in continuous laminating processes or put in vertical drying towers for the purpose of manufacturing prepregs or dry lay-ups. Felts with no binder require carriers to permit them to pass through resin baths and drying towers. Felts with binders and Novabestos papers above 5 mils thick can be resin treated and, when volatiles have to be removed, they can be sent unsupported through a 60-ft. vertical tower. Prepregs with various resins including phenolics, polyesters, and epoxides on felts or papers have been standard production items. These felts and papers have contributed to the elimination or reduction of resin surface crazing of reinforced plastics using complex resins.

Resistance to breakdown of asbestos laminates exists when they are exposed to high temperatures. Parts have withstood temperatures of 2500° F. for 60 sec. and 3500° F. for 6 to 10 seconds. Parts requiring low strength have been used in continuous exposure at a temperature of 300° F. for periods of at least 1 year. It is interesting to note that some press-cured phenolic-felt laminates can increase their physical properties up to 40% by postcuring. To develop maximum strength, parts have been postcured for different cycles such as 3 to 5 days from temperatures of 250 to 350° F. or one-half to a full day from 350 to 400° F. Time and temperature cycles for postcuring depend on thickness and shape of part. For requirements where initial strength does not require maximum properties and it is desired to subject parts for long periods of time at 300 to 350° F., no postcuring is recommended.

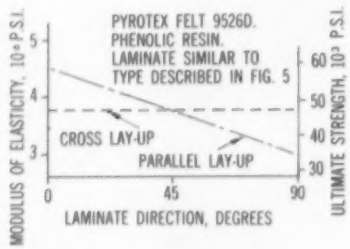

Fig. 3: Flexural directional properties of asbestos felt laminates

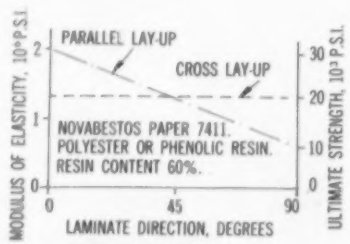

Fig. 4: Flexural directional properties of asbestos paper laminates

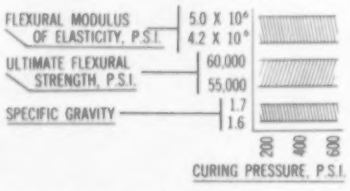

Fig. 5: Properties *versus* laminating pressure of asbestos felt laminates (Pyrotex felt, Style 9526RB1; phenolic resin; parallel lay-up; press- and postcured; laminate thickness 40 to 150 mils; resin content 38 to 42%; room temperature longitudinal data)

Asbestos base materials can be oriented in various patterns in order to produce laminates having varying directional properties (see Figs. 3 and 4). When using asbestos fabrics, an isotropic laminate can be made by laying up asbestos sheets at least 60 degrees to each other, provided there are an equal number of laminations in each direction. The asbestos fabrics behave and are available in forms similar to standard fabrics such as square woven, unidirectional, and knitted fabrics. Directional properties of fabrics do not follow the patterns similar to asbestos felts, mats, or papers. In the case of felts, mats, and papers, isotropic properties can be obtained by laying up plies only at 90 degrees to each other. Asbestos felts or mats can be made to produce isotropic or relatively unidirectional properties.

Outstanding properties

Since it is inorganic, asbestos has great heat resistance and can be heated to high temperatures without damage. Limited tests have been conducted on asbestos laminates that have been exposed to temperatures up to 4000° F. for short exposure (seconds to minutes) and the laminates have remained intact and retained strength and stiffness. Pyrotex felt laminates with flexural properties of 4.5 million p.s.i. modulus of elasticity and 55,000 p.s.i. ultimate strength retained 75% of their modulus properties and 60% of their ultimate strength when tested at 700° F. after ½ hr. at 700° F.

The physical properties of laminates are largely dependent upon type of mold, molding pressure (see Fig. 5), and the asbestos-resin ratio used. This characteristic is similar to those of other reinforcements. The flow characteristics of the laminating resin contained in the treated felts, mats, or papers should be established to coincide with the molding or laminating pressure and techniques to be employed.

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• Information on Tenite can be obtained from local representatives listed under "Plastics—Tenite" in the classified telephone directories of the following cities: Chicago, Cleveland, Dayton, Detroit, Houston, Leominster (Mass.), Los Angeles, New York City, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, Seattle and Toronto—elsewhere throughout the world, from Eastman Kodak Company affiliates and distributors.

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felts and mats are available that produce, in a parallel lay-up, laminated tensile and flexural modulus of elasticity values of at least 5 to 5½ million p.s.i. Pyrotex felts used to obtain high modulus of elasticity and other properties have been principally evaluated with phenolic resin (see Table III, below). Other resins have been used; however, only limited data are available (see Tables IV and V, below).

Table III: Properties of asbestos felt-phenolic resin laminates[a]

Properties at room temperature	*Pyrotex felt style* 9526RB1	9517RB1
Flexural properties		
E, 10^6 p.s.i.	4.5	2.8
Ultimate strength, p.s.i.	55,000	35,000
Tensile properties		
E, 10^6 p.s.i.	5.0	3.5
Ultimate strength, p.s.i.	50,000	24,000
Compressive properties*		
E, 10^6 p.s.i.	4.3	—
Ultimate strength, p.s.i.	30,000	—
Percent retention of properties		
Immersion in water (30 days)		
Flexural properties		
E,%	95 to 100	95 to 100
Ultimate strength, %	95 to 100	95 to 100
Tensile properties		
Ultimate strength, %	95 to 100	95 to 100
At 300° F. after 200 hr. at 300° F.		
Flexural properties		
E,%	90	—
Ultimate strength, %	87	—
At 500° F. after 100 hr. at 500° F.		
Flexural properties		
E, %	86	—
Ultimate strength, %	72	—
At 700° F. after ½ hr. at 700° F.		
Flexural properties		
E, %	75	—
Ultimate strength, %	60	—

[a]Laminate history (both styles):
Parallel lay-up;
35 plies;
⅛ in. thickness;
specific gravity 1.6 to 1.7;
resin content 37 to 40% by wt.;
press cure under 200 p.s.i. for 30 min. at 300° F.;
posteure 8 hr. at 350° F., followed by 8 hr. at 400° F.;
phenolic resin.
Longitudinal test data (data with * obtained outside of R/M).

Table IV: Properties of asbestos felt-silicone resin laminates[a]

Pyrotex felt reinforcement	*Cure[b] at 250° C.*	*Flexural strength at room temperature*	*Flexural strength[c] at 500° F.*
	hr.	*p.s.i.*	*p.s.i.*
9526 NS	40	31,300	14,400
9529 NS[d]	40	34,800	10,700
9526 NS	300	29,700	16,400
9529 NS[d]	300	32,900	16,000

[a]Dow Corning DC-2106 silicone resin was impregnated in Pyrotex felts. Laminates were parallel lay-ups, pressed at 300 p.s.i. for 30 min. at 175° C., ⅛ in. thick, 25 plies, 45 to 50% resin content and 1.7 to 1.8 specific gravity. These data were obtained from Dow Corning Corp.

[b]Prior to heating at 250° C., the laminates were heated 16 hr. at 90° C., 2 hr. each at 125, 150, 175, 200, and 225° C.

[c]Tests conducted at 500° F. after 0.5 hr. exposure in addition to the aging listed in footnote b. To determine the effect of higher temperatures, laminates were tested after exposure of 1 hr. each at 400, 500, 600, 700, 800, 900, and 1000° F. The ultimate flexural strength tested at room temperature was 13,400 p.s.i.

[d]Pyrotex felt Style 9529 is a modification of Style 9526 through the addition of an open-weave glass cloth. This construction is similar to Style 9524 described in R/M Technical Bulletin T-55.

Applications exist where the dimensional stability of these products make them useful. Laminates and molded products have been subjected to high temperatures of 300 to 350° F. in dry or wet steam with relatively no change in dimensions or strength. Dimensions and physical properties retain practically all their dry properties after 2-hr. boil or 30-day immersion in water.

An interesting characteristic of reinforced plastics using the asbestos felts, mats, or papers is that when parts are deliberately ruptured, they do not tend to delaminate. The parts lose their identity as being made up of sheet material and act as one composite structure.

Asbestos felts and papers have been found to be most desirable when parts require drapability. When reinforcements are wetted with resin, they conform to curved shapes.

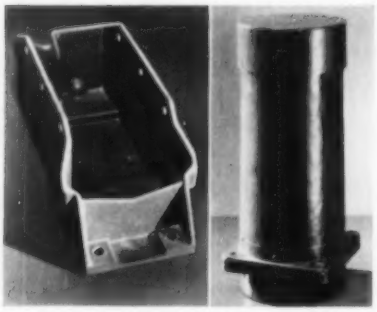
Asbestos felts and papers are especially applicable for thin laminates, 1/16 in. or less, where they retain their strength characteristics. The Novabestos papers have produced particularly high values of physical properties in thin laminate sections (see Table VI, p. 148). When combining asbestos and glass, the fine asbestos will fill resin pockets and surround glass fibers. Resin pockets are thereby reinforced with the asbestos. Also, the asbestos, in surrounding the glass fibers, acts as a cushioning agent to protect the fibers from abrasion caused by glass-to-glass contact. Papers have outstanding ability to stretch and distort, both dry

Table V: Properties of asbestos felt-polyester laminates[a]

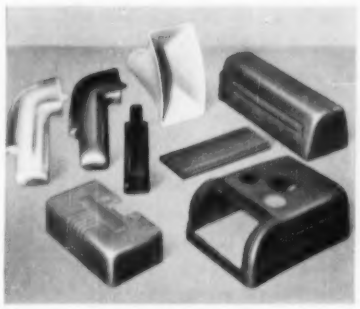
Property	*Pyrotex felt 9517RB 3*
Specific gravity	1.45 to 1.55
Ultimate flexural strength, 10^3 p.s.i.	25 to 32
Flexural modulus of elasticity, 10^6 p.s.i.	1.6 to 2.0

[a]Parallel lay-up; press cure 15 to 50 p.s.i.; 40 to 60% resin content. Longitudinal test data.

When to use HETRON® polyester



Physical Property		Rigid Resins		Semi-rigid Resin
		HETRON 92	Avg. 10 Others	HETRON 32A
Flexural Strength, PSIx10³	Room Temp.	38.6	36.4	41.8
	180°F.	25.0	18.6	23.5
Flexural Modulus, PSIx10⁶	Room Temp.	1.88	1.61	1.82
	180°F.	0.90	0.79	0.85

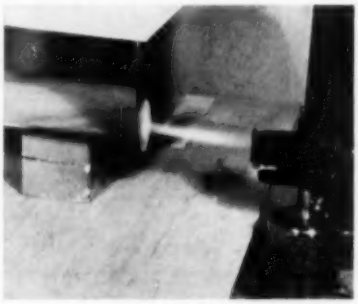


1. To make your own pre-mix. The range of properties offered in HETRON resins gives you the performance needed for almost any pre-mix molded part. Fire resistance, heat resistance, and high strength are built-in.

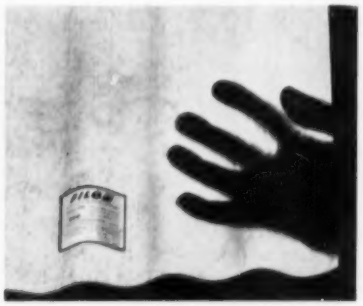
2. When high flexurals are important. You get extra flexural strength with HETRON. Other advantages: unusually high impact strength; very high heat resistance; excellent tensile strength; very low water absorption.

3. When you want a baked-on finish. Parts like these, molded with HETRON, take an alkyd finish baked on at high temperatures for 90 minutes—with no surface crazing. There's practically no surface shrinkage during cure.

4. For aircraft. Some HETRON resins, including semi-rigid HETRON 32A, are manufactured to meet MIL-R-7575A, Types I and II. HETRON 92, with up to 10% added styrene, meets MIL-R-7575A, Types I, II, and III.



5. When you need fire resistance. HETRON won't burn except under direct hot flame—snuffs out as soon as flame source is removed. Here, test structure is virtually unaffected by 15-minute exposure to hot blowtorch flame.



6. When your product must meet building codes. If you need specific flame-spread data, often required by building officials, choose a HETRON-based material. This fabricated sheet, for example, has Underwriters' listing and label.

You get more than fire resistance with HETRON. Specify it for its outstanding strength, or its excellent molding properties—and get fire resistance, too, as a desirable "extra." To discover how well HETRON can meet your design requirements, send for the complete data file on HETRON resins. Ask also for list of reputable fabricators working with HETRON.

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and wet. In very thin laminates, the smoothness and uniform fiber distribution is particularly evident, providing greater uniformity of thickness and physical properties. The papers may be used alone in laminates, or can be effectively combined with glass cloth or yarn as surfacing or interleaving materials.

Like other reinforced plastics, asbestos laminates have no definite yield point. The stress-strain curve is virtually straight with a small curved portion immediately prior to failure (see Fig. 6, below).

Table VI: Properties of asbestos paper laminates[a] made with polyester or phenolic resin

Property	*Novabestos paper 7411 or 7412*
Specific gravity	1.2 to 1.5
Tensile properties	
Ultimate strength, p.s.i.	20,000 to 30,000
Modulus of elasticity, 10^6 p.s.i.	1.5 to 2.5
Flexural properties	
Ultimate strength, p.s.i.	24,000 to 40,000
Modulus of elasticity, 10^6 p.s.i.	1.4 to 2.0
Ultimate compressive strength, p.s.i.	24,000 to 45,000

[a]Parallel lay-up; press cure 15 to 200 p.s.i.; 0.10 to 0.15 in. thick; 60 to 70% resin content. Longitudinal test data.

Outstanding applications

Since the entry of asbestos felts and papers into the low-pressure laminating field, many applications have evolved in which asbestos or the combination of asbestos and glass provide superior qualities. These applications include paneling on air ducts in railroad cars, truck trailers, and aircraft; missile fins and vanes; containers for fuels, chemicals, and delicate instruments; electrical cables, insulators, and switch gears; fire walls; rocket and jato throats; fishing rods; corrugated panels; decorative sheets; and surfacing sheets for wood. Also in the area of high-speed aircraft applications are airfoil sections made up of polyester-impregnated asbestos felts as the skin of a sandwich construction with a foamed isocyanate core. Still another application under consideration is the use of asbestos felts and papers for honeycomb cores that produce higher strength and stiffness properties at both lower and higher temperatures than standard cores.

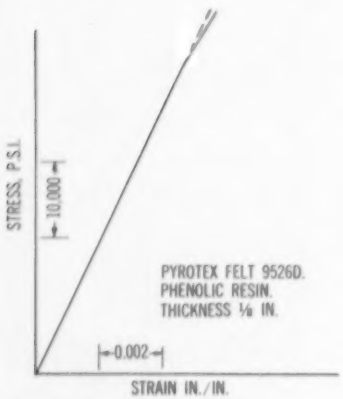


Fig. 6: Typical tensile stress-strain curve for asbestos felt laminates

Combinations of asbestos felts with glass cloth (Style 9524) and asbestos papers with glass fibers produce reinforced plastics with desirable properties. Style 9524 with phenolic resin binder and laminating resin has been used to produce heat-resistant pipes. Such pipes have been subjected to 130 p.s.i. steam pressure for over 6 mo. without weeping or leaks.

Pyrotex felts and Novabestos papers are being interleaved between plies of glass fiber reinforcements in such applications as boat hulls, containers, and tanks for the purpose of improving resistance to leakage of the vessels and/or increasing their toughness.

Novabestos Cushioned Glass Warp (see Table VII, below) is another material in which asbestos and glass are combined to good effect.

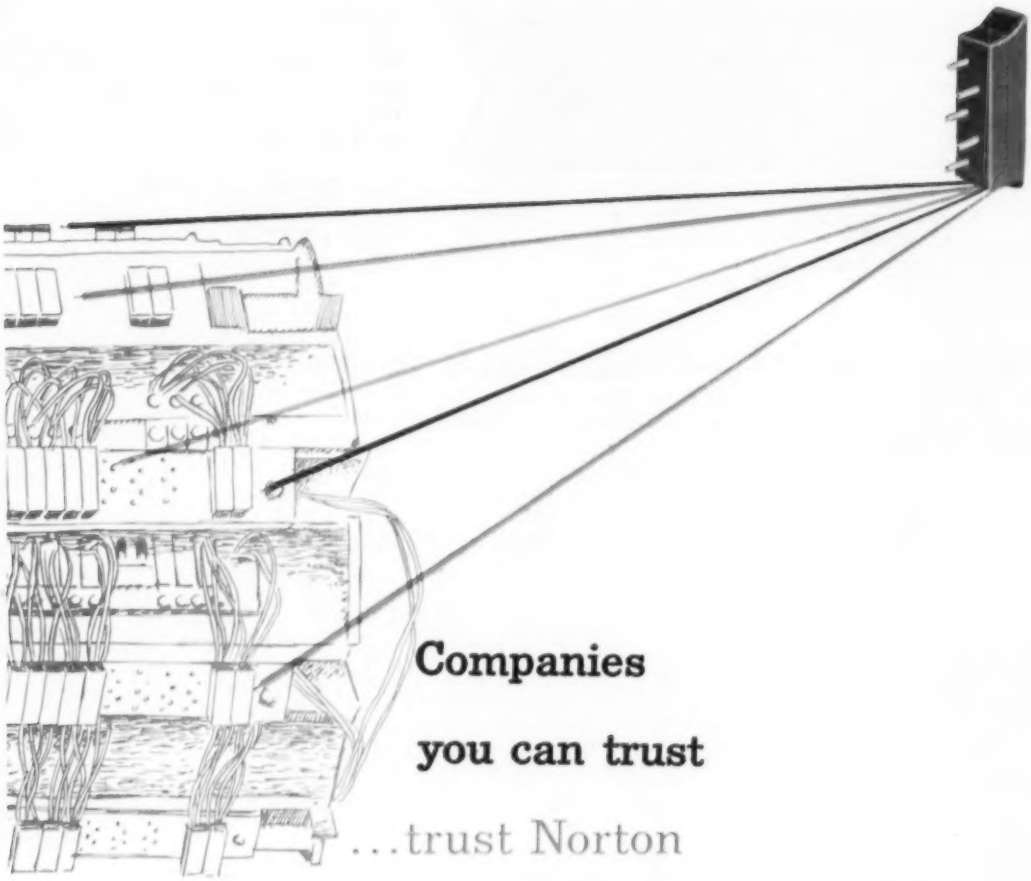
It is well known that fibrous glass in a parallel lay-up produces high-strength laminates. By surfacing glass warp with Novabes-

(*To page* 202)

Table VII: Properties of Novabestos Cushioned Glass Warp laminates[a]

Property	
Uncured warps (Style 7550K1 [160 glass warp ends per inch])	
Thickness, mils	14 to 17
Composition by wt.	
Epoxy resin, %	48 to 52
Novabestos paper, %	18 to 22
Glass Warp (150's 1/0)	28 to 32
Weight, approx., lb./sq. yd.	1
Cured laminates	
Specific gravity	1.6 to 1.7
No. of plies for ⅛ in. thickness	9 to 10
Tensile properties	
Ultimate strength, p.s.i.	70,000 to 90,000
Modulus of elasticity, 10^6 p.s.i.	4 to 5
Flexural properties	
Ultimate strength, %	90,000 to 110,000
Modulus of elasticity, 10^6 p.s.i.	3 to 4
Compressive strength, p.s.i.	50,000 to 60,000

[a]The cured laminates had the following history: parallel lay-ups; curing time of 1 hr. at 350° F. and 10 to 50 p.s.i. Tests conducted in longitudinal direction. Warps stretched during curing in order to hold glass warps straight and oriented. When wound, there is sufficient tension to hold glass warps straight and oriented. Laminates approximately ☆ in. thick cured without stretching produce values listed above. Thicker laminates not stretched may have values 20% less.



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Plastics Digest

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

Materials

Reaction and cure in melamine plastics. H. P. Wohnsiedler, I. H. Updegraff, and R. H. Hunt, Jr. Ind. Eng. Chem. *48*, 82-85 (Jan. 1956). Optimum properties of melamine resins and other plastics can be realized when the relationship of particular properties to cure is known. Empirical methods can be used to achieve this but it is of interest to know what significance attaches to cure when it is expressed in terms of degree of reaction. Physical properties of the plastic were determined over a broad cure range. Heat distortion, flexural strength, and water absorption reach their optimum values at different degrees of reaction whereas modulus of elasticity undergoes little or no change with degree of reaction. Degree of polymerization and polymer structure are also related to degree of reaction but a number of alternative interpretations of average states are possible. By assigning the methylene bridge as the most plausible linking mechanism it appears that the best properties of the plastic are associated with significant cross-linking.

Kralastics. E. J. Trunk. Product Eng. *26*, 171-73 (Nov. 1955). Kralastics are a new series of thermoplastic materials combining high strength, toughness, and resistance to heat and corrosion. They are a blend of styrene-acrylonitrile resins and butadiene-acrylonitrile rubber. The blending of these in various proportions produces a series of thermoplastic gum materials that can be extruded, and injection and transfer molded. Five types have been developed, each designed for specific applications. The mechanical properties of the five grades are listed. Production tolerances for molding and extruding conditions are given. An important application for this new material is in pipe, where the high strength gives resistance to creep under high internal pressure. Largest use to date has been in oil fields handling both brine and crude. Maximum working temperatures for Kralastics are from 170 to 250° F. depending on the type. They are subject to attack by esters, chlorinated solvents, ketones, and aromatic hydrocarbons. They have a very favorable weight-strength ratio.

Polyvinyl chloride for molded parts. C. W. Bulkley. Elec. Mfg. *56*, 106-12 (Nov. 1955). Electrical and physical properties of polyvinyl chloride, as well as molding considerations, are reviewed from the design-engineering point of view. A wide range of physical properties can be obtained. Polyvinyl chloride can be injection molded on conventional molding equipment. The experience required to tailor-make polyvinyl chloride compounds is easily acquired but requires caution. The designer should not specify an impossible combination of properties. As with other materials, there is an optimum set of properties that can be obtained. In formulating the compound, the type and amount of plasticizer are highly important. Fillers and pigments in proportions exceeding 10% of the resin detract from the physical properties of the compound, but concentrations of filler up to 60 parts per 100 parts of resin can be tolerated. The choice of stabilizers against heat and light is highly important. Successful applications include vacuum cleaner parts, snap-on fittings, abrasion-resistant covers, washers, gaskets, television yoke assemblies, automotive distribution nipples, and molded electrical cord plugs.

'Bascodur,' a highly corrosion-resistant material for the chemical industry. W. Kunzer and K. Vogel. Der Plastverarbeiter *6*, 458-65 (Dec. 1955). Bascodur, a thermosetting plastic, is manufactured by the Badische Anilin- und Soda Fabrik, A. G., from a modified phenol-formaldehyde resin with a graphite or carbonaceous filler. It is highly resistant to corrosion from acids and alkalies even in the presence of solvents. It has a high heat resistance and excellent mechanical properties. In this material the hydroxyl groups that cause low resistance to chemicals, especially to alkalies, are blocked off by aromatic hydrocarbons of higher molecular weight. Tables on the resistance to more than 100 chemical reagents and of the mechanical properties are included, as well as photographs of applications of Bascodur.

Molding and fabricating

Extruders with fast moving screws. E. Beck. Kunststoffe *46*, 18-20 (Jan. 1956). A new extruder is being developed which works on the following principles: higher revolutions per minute of the screw than is used in conventional extruders; stabilization of the extrusion process not in accordance with the temperature variations but with variations in viscosity of the molding compound to which the screw itself is sensitive, i.e., with increasing viscosity the screw will obtain more energy from the motor.

Applications

Research progress in dielectrics—1955. A. E. Javitz. Elec. Mfg. *56*, 90-98 (Dec. 1955). The results derived from both fundamental research and engineering studies on dielectrics during 1955 are reviewed and interpreted on the basis of papers presented at the Annual Meeting of the Conference on Electrical Insulation of the National Academy of Sci-

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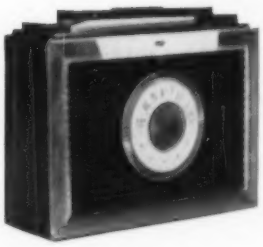

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ences, National Research Council. Emphasis is on breakdown and deterioration studies and on test instruments and techniques. Highlights include measurement of corona effect, surface failure of solid insulators, basic physical tests on silicones, development of arc-resistant organic insulation, a new ferro-electric, and breakdown studies in liquids and gases.

Effect of high-melting paraffins added to polyethylene molded into tubes and bottles. G. Beutlin. Kunststoffe *46*, 133-36 (Mar. 1956). Ten to 20% of paraffins produced by the Fischer-Tropsch synthesis with iron catalysts under high pressure were added to high-pressure polymerized polyethylene. Tubes and bottles became more rigid, a desirable property for large bottles. The water vapor permeability as well as the permeability of other gases and aromatic odors decreased.

New epoxy adhesive. B. Gould. Materials & Methods *42*, 140-42 (Dec. 1955). An epoxy-based paste adhesive that can be used directly from the container is described. The need for mixing separate resin and hardener has been eliminated by introduction of stable, compatible thixotropic agents and the addition of hardener systems that combine a practical curing cycle with good storage stability in the presence of the reactive liquid epoxy resin. Curing cycles range from 7 min. at 535° F. to 24 hr. at 260° F. The shelf life is six months. The thixotropic property of the new adhesive completely eliminates drip or flow either before or during cure. In addition to savings in cost and time, the new adhesive possesses physical and mechanical properties at room temperature that are as good, or better than those of the older two-component materials.

Rubber and plastics as materials of construction in the field of atomic energy. R. H. Burns and H. Wells. Rubber & Plastics Age *37*, 33-34 (Jan. 1956). The uses of rubbers and plastics in the construction of atomic installations are reviewed. Data on ease of decontamination are given.

Coatings

Coatings: How to sell a $700-million market. H. Burrell. Chem. Week *78*, 71-2, 74, 76, 81-2, 86, 88 (Mar. 17, 1956). The economics of the organic coatings field are discussed in detail.

Lacquer or enamel? J. B. Campbell. Materials & Methods *42*, 88-92 (Dec. 1955). The factors involved in the choice of a pigmented lacquer or enamel finish for metal are discussed. Both lacquer and enamel have important advantages and limitations. Lacquers cure by simple evaporation of solvent; enamels cure by evaporation of solvent and by oxidation or polymerization of the resin base. Both lacquers and enamels can be formulated to cure with or without heat. A glossy finish is more readily and more economically obtainable with an enamel. Wrinkled textures are not available in lac-

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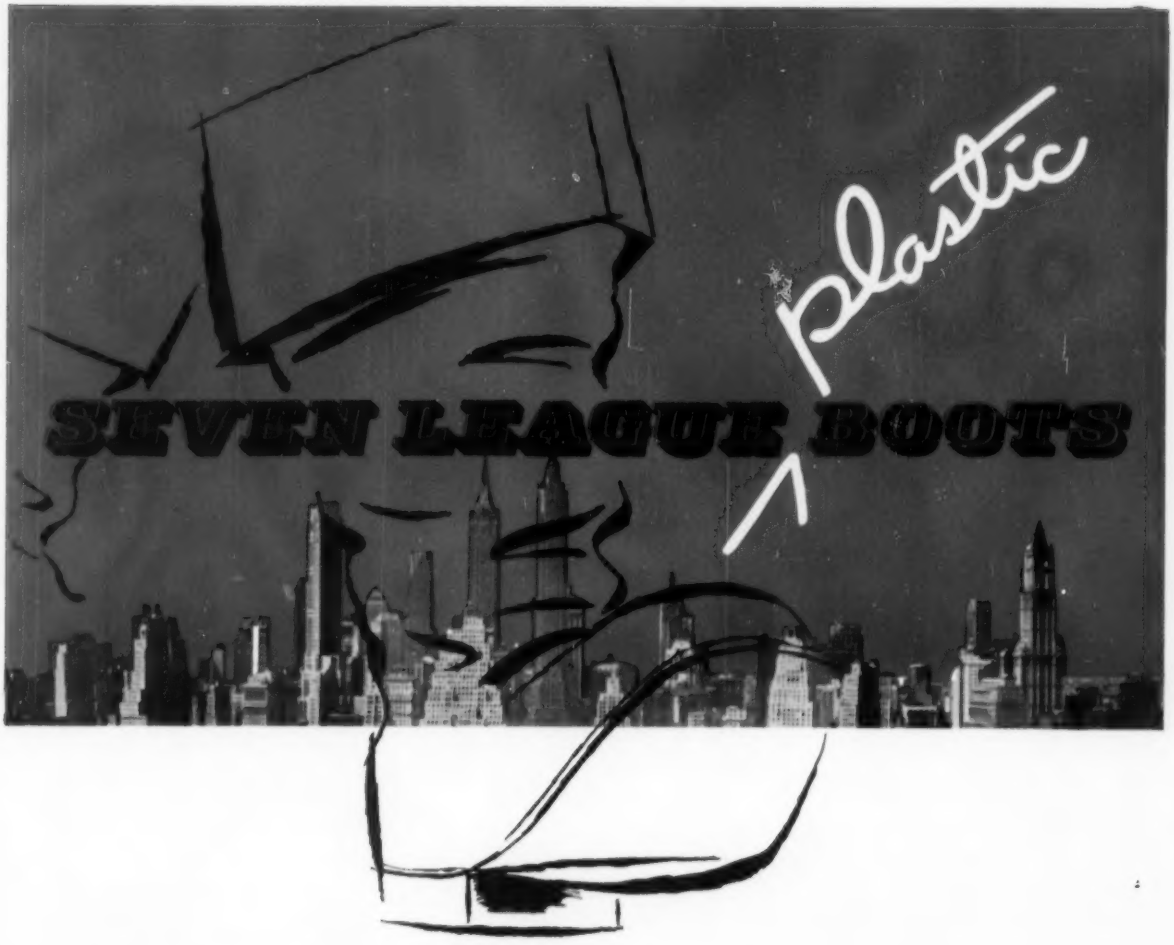

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quers. Enamels have better adhesion and better outdoor weathering resistance than lacquers; enamels also withstand higher temperatures. Usually, fewer coats of enamel are required to yield a given thickness. Both lacquers and enamels can be readily sprayed, but enamels are generally more satisfactory for dipping, roller-coating, or flow-coating. Since a lacquer dries more quickly, it is preferable to enamel where drying space is limited or where quick assembly is desired. Lacquers reach their maximum hardness quickly; new enamel films have a hardness gradient that makes them more susceptible to damage in the early part of their life and likely to contain internal stresses that make them inherently more likely to check. Enamels usually possess the better flexibility and better low temperature resistance. A wider selection of colors is possible with lacquers because of their faster setup and lower curing temperatures. The materials cost of a lacquer may approach twice that of an enamel. Lacquers are much more adaptable to repairs than enamels; since a coat of repair lacquer tends to blend into the old film, a spot repair is possible; with enamel, the entire part must be repainted to avoid a spotty appearance.

Properties

Adhesive bonding of metals. S. N. Muchnick. Mech. Eng. *78*, 19-22 (Jan. 1956). The strengths of adhesive-bonded metal joints can be made to approach the cohesive strength of the bonding agent if the metal surfaces are cleaned rigorously. The contact angle which a water drop makes with a treated surface is an effective tool for evaluating the adequacy of the treatment. A study was made of the changes in surface properties of aluminum, stainless steel, magnesium and titanium when treated with solvents and acid and alkaline solutions, using contact angle as the criterion. A treatment that renders one metal surface suitable for bonding will not necessarily prepare another surface adequately. It was found that the chemical

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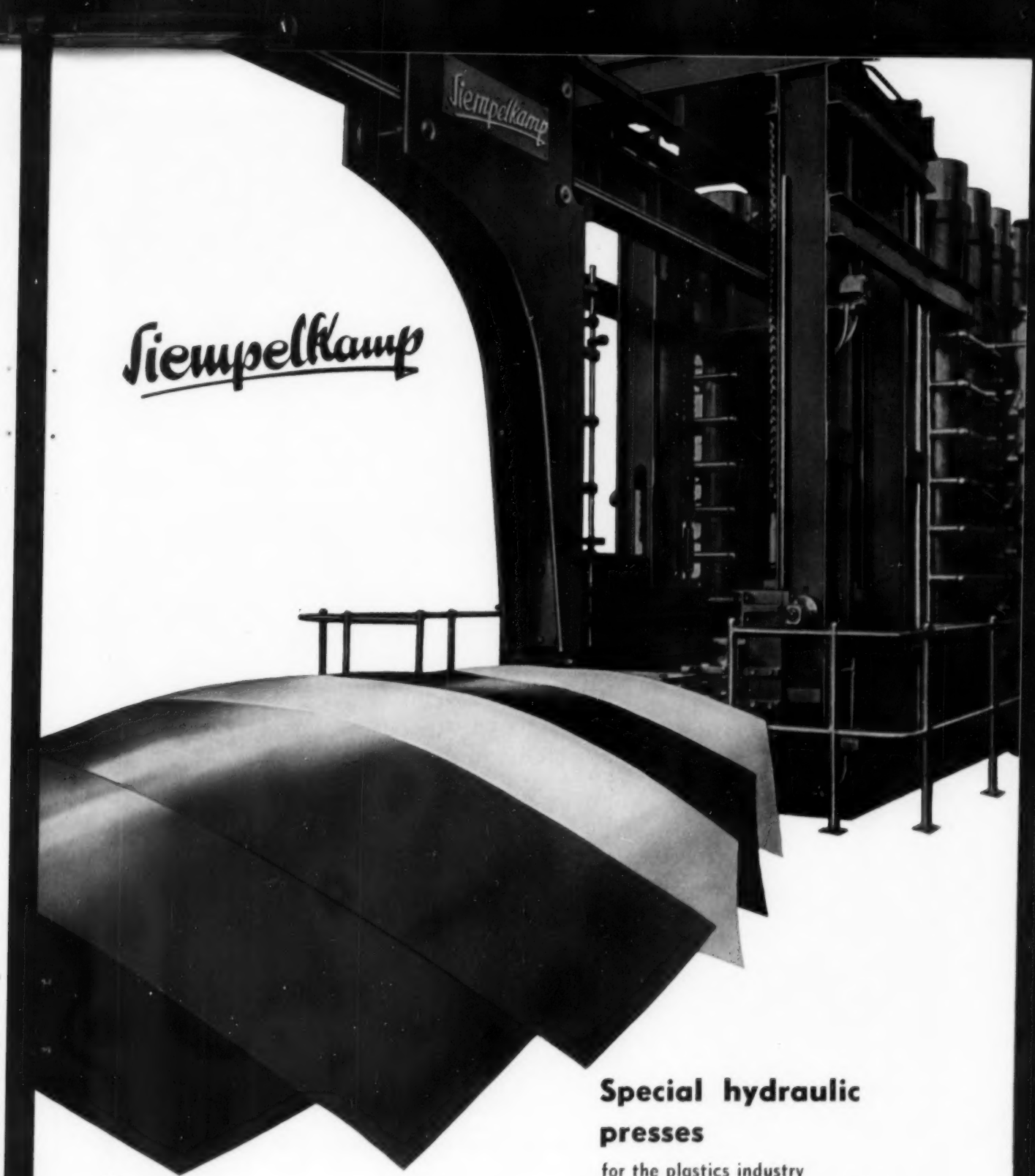
nature of the film on a metal surface is not as significant as the thickness of the film in influencing the strength of an adhesive-bonded joint. Also, procedural techniques significantly affect joint strength. A theoretical basis for the bonding of metals by means of organic adhesives is presented.

Permeability of polymer films to hydrogen sulfide gas. W. Heilman, V. Tammela, J. A. Meyer, V. Stannett, and M. Szwarc. Ind. Eng. Chem. *48*, 821-24 (Apr. 1956). The permeability of plastic films to hydrogen sulfide is of interest in several specialized packaging applications and because the gas is an analog of water vapor. Permeabilities of a number of polymeric films were investigated over a wide range of pressures and temperatures. The diffusion constants were determined from the approach to the steady state, and in some cases the solubility coefficients were determined by sorption technique, using a helix microbalance. The experimental procedure is described in detail. The results are discussed and interpreted from the point of view of the structure of the polymer films.

Testing

Fluorescent sunlamps in laboratory aging tests for plastics. F. W. Reinhart and M. K. Mutchler. ASTM Bulletin No. 212, 45-51 (Feb. 1956). A new method of test for laboratory aging (accelerated weathering) of plastics is described. This method utilizes a fluorescent sunlamp in a modification of Method 6021 in Federal Specification L-P-406. The results of the tests indicate that slightly more deterioration, but of the same type, is obtained with the fluorescent sunlamps than with the S-1 sunlamp now specified in Method 6021. The results also correlate very well with those obtained outdoors in Washington, D. C., except for the vinyl chloride plastics for which the correlation is only fair. The fluorescent sunlamp offers the following advantages over the S-1 sunlamp; a) it is cheaper; b) it can be used for a longer period; c) it does not require the use of



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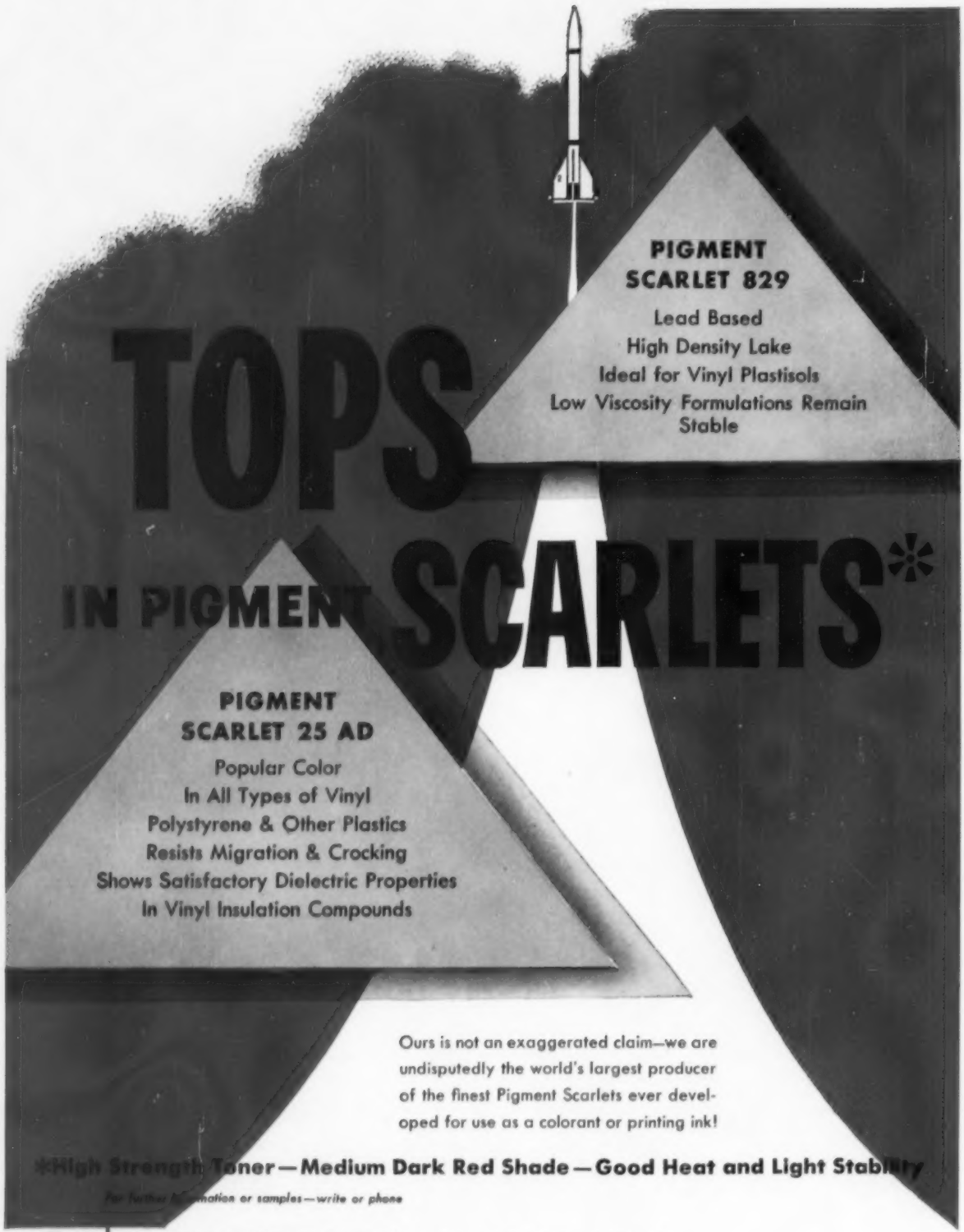
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a special fixture; d) the temperature of the test specimens can be controlled more readily because of the low heat output; e) larger areas of material can be exposed; f) the tested areas are more uniformly radiated and deteriorated.

Chemistry

Heterogeneous catalysis. M. Boudart and T. Kwan. Ind. Eng. Chem. *48*, 562-69 (Mar. 1956). Recent advances in the field of heterogeneous catalysis are reviewed.

Cis- and trans-polyester formed by condensation of geometric isomers of 2-butene-1,4-diols and ethene-1,2-dicarboxylic acids. W. M. Smith, K. C. Eberly, E. E. Hanson, and J. L. Binder. J. Am. Chem. Soc. *78*, 626-30 (Feb. 5, 1956). The synthesis of exclusively cis and exclusively trans polymers is reported for the first time. Low - molecular - weight polyesters of both cis- and trans-2-butene-1, 4-diol with maleic and fumaric acid were synthesized and characterized. The monomers and polymers hydrogenate at significantly different rates. Only the all-trans polymer was crystalline by X-ray methods. The all-cis polymer was successfully cross-linked to give a clear film. No isomerization of the all-cis and all-trans polymers was indicated by chemical, X-ray, and infra-red analyses.

Publishers' addresses

ASTM Bulletins: American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

Chemical Week: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.

Industrial and Engineering Chemistry: American Chemical Society, 1115 Sixteenth St., N.W. Washington 6, D.C.

Journal of the American Chemical Society: American Chemical Society, 1115 Sixteenth St., N.W. Washington 6, D.C.

Kunststoffe: Karl Hanser Verlag, Leonhard-Eck-Strasse 7, Munich 27, Germany.

Materials and Methods: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Mechanical Engineering: American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.

Der Plastverarbeiter: Kurt Brandenburger, Klosterstrasse 182, Edenkoben/Pfalz, Germany.

Rubber and Plastics Age: The Rubber and Plastics Age, 147 Grosvenor Rd., Westminster, London S.W. 1, England.

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U.S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each

Adhesives. J. F. Dexter (to Dow Corning). U. S. 2,736,721, Feb. 28. Adhesives from mixed siloxanes and a titanium ester.

Copolymers. J. A. Price (to American Cyanamid). U. S. 2,736,722, Feb. 28. Acrylonitrile-acrylylcarbamate copolymers.

Polymers. F. W. Brener and B. F. Hofferth (to Armstrong Cork). U. S. 2,736,723, Feb. 28. Mercaptan modified hydrocarbon polymers.

Molding. W. J. Schieser and J. F. Kelley (to Exact Weight Scale). U. S. 2,736,922-3, Mar. 6. Injection molding machine.

Hollow articles. J. S. Heisler, A. Heisler, and A. J. Starr. U. S. 2,736,925, Mar. 6. Forming hollow polyethylene articles.

Extrusion. W. E. Wolstenholme (to U. S. Rubber). U. S. 2,737,023, Mar. 6. Apparatus for rapidly cooling extruded stock.

Coating. J. S. Heisler, A. Heisler, and A. J. Starr. U. S. 2,737,461, Mar. 6. Polyethylene coatings on metal surfaces.

Polyethylene. W. M. Land, Jr. and W. T. Meyer (to Carbide and Carbon). U. S. 2,737,502, Mar. 6. Polyethylene modified with a copolymer of vinyl chloride and an octyl acrylate.

Polyvinyl chloride. G. R. Sprague and F. M. Scantlebury (to B. F. Goodrich). U. S. 2,737,503, Mar. 6. Expanded polyvinyl chloride.

Stabilizer. R. W. Finhold (to General Electric). U. S. 2,737,505, Mar. 6. Polychlorotrifluoroethylene stabilized with chromic oxide.

Heat sealing. G. T. Schjeldahl (to Herb-Shelly). U. S. 2,737,999, Mar. 13. Heat-sealing of thermoplastic sheets.

Copolymer. M. T. Harvey (to Harvel). U. S. 2,738,338, Mar. 13. Copolymer of styrene and butadiene and partially hydrogenated furfuralketone product.

Phenolic resins. R. S. Taylor and L. N. Whitehill (to Sherwin-Williams). U. S. 2,738,339, Mar. 13. Phenolic condensates made with divalent tin compound to reduce colorations.

Resins. A. L. Ayers and C. R. Scott (to Phillips Petroleum). U. S. 2,738,341, Mar. 13. Resinous condensates of peroxides and alkene thiols.

Copolymer. A. L. Dittman, H. J. Passino, and W. O. Teeters (to M. W. Kellogg). U. S. 2,738,343. Mar. 13. Copolymer of trifluorochloroethylene and vinylidene fluoride.

Molding. A. M. Howald (to Glaskyd). U. S. 2,738,551, Mar. 20. Transfer molding.

Welding. S. Hammer. U. S. 2,738,828, Mar. 20. Apparatus for welding plastic film.

Cellulosic film. C. R. Fordyce and B. E. Gramkee (to Eastman Kodak). U. S. 2,730,069-70, Mar. 20. Cellulose mixed ester film.

Strip. B. H. Hageltorn (to Svenska Aktiebologet Polva). U. S. 2,739,089, Mar. 20. Plastic strips.

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Film. N. M. Adams. U. S. 2,739,128, Mar. 20. Polyorganosiloxane film-forming compositions.

Foam. H. L. Parry and B. O. Blackburn (to Shell). U. S. 2,739,134, Mar. 20. Foaming composition containing a glycidyl polyether of a dihydric phenol.

Hydrosols. W. F. Fowler, Jr. (to Eastman Kodak). U. S. 2,739,137, Mar. 20. Methacrylamide, *n*-butyl acrylate, styrene hydrosol.

Polyamides. R. Gabler and P. K. Ems (to Inventa, A. G., Forschung and Patentverwertung). U. S. 2,739,139, Mar. 20. Polyamides containing chromium salts as light stabilizers.

Polymers. R. M. Price and A. F. Roche (to Dow). U. S. 2,739,140, Mar. 20. Color stabilization of acrylonitrile polymers.

Coplymers. J. L. Ernst and R. M. Thomas (to Esso). U. S. 2,739,141, Mar. 20. Unsaturated copolymers of isobutylene.

Copolymers. C. Jones, Bittarris, and F. L. Ingley (to Dow). U. S. 2,739,142, Mar. 20. Moldable copolymers of styrene and acrylonitrile.

Weather strip. A. T. Kunkel. U. S. 2,739,358, Mar. 27. Plastic weather strip.

Postforming. T. V. Tyler (to North American Aviation). U. S. 2,739,636-7, Mar. 27. Apparatus for bending postformable plastic material.

Resins. D. W. Lewis and H. M. Philofsky (to Westinghouse). U. S. 2,739,638, Mar. 27. Polymerizable silicon-containing composition.

Pipe joint. J. W. Pedlow and L. B. Cundiff (to American Viscose). U. S. 2,739,829, Mar. 27. Plastic pipe joint.

Ion exchange. K. L. Berry and J. R. Caddell (to Du Pont). U. S. 2,739,906, Mar. 27. Ion exchange resin.

Coatings. A. R. McGarvey (to Armstrong Cork). U. S. 2,739,910, Mar. 27. Scrub-resistant vinyl acetate coatings.

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Polymers. W. O. Forshey, Jr. (to Du Pont). U. S. 2,739,949, Mar. 27. Polymers of dialkyl methallylimino dialkanoates.

Resins. R. G. Linville (to General Electric). U. S. 2,739,952, Mar. 27. Stabilized organopolysiloxanes.

Coating. E. Rogers (to Engine Parts). U. S. 2,739,953, Mar. 27. Coating containing polymethyl methacrylate dissolved in halogenated solvent.

Resin. D. Wasserman (to Harvel). U. S. 2,739,955, Mar. 27. Ether of phenol-aldehyde resin.

Polymers. J. L. R. Williams (to Eastman Kodak). U. S. 2,739,956, Mar. 27. Polymers of methoxy vinylnaphthalenes.

Resin. H. R. Billica and J. J. Carriel (to Du Pont). U. S. 2,739,957, Mar. 27. Polyethylene terephthalate.

Polymers. J. Lincoln, K. M. Hammond, and W. H. Groombridge (to British Celanese). U. S. 2,739,958, Mar. 27. Nitrogen-containing polyesters.

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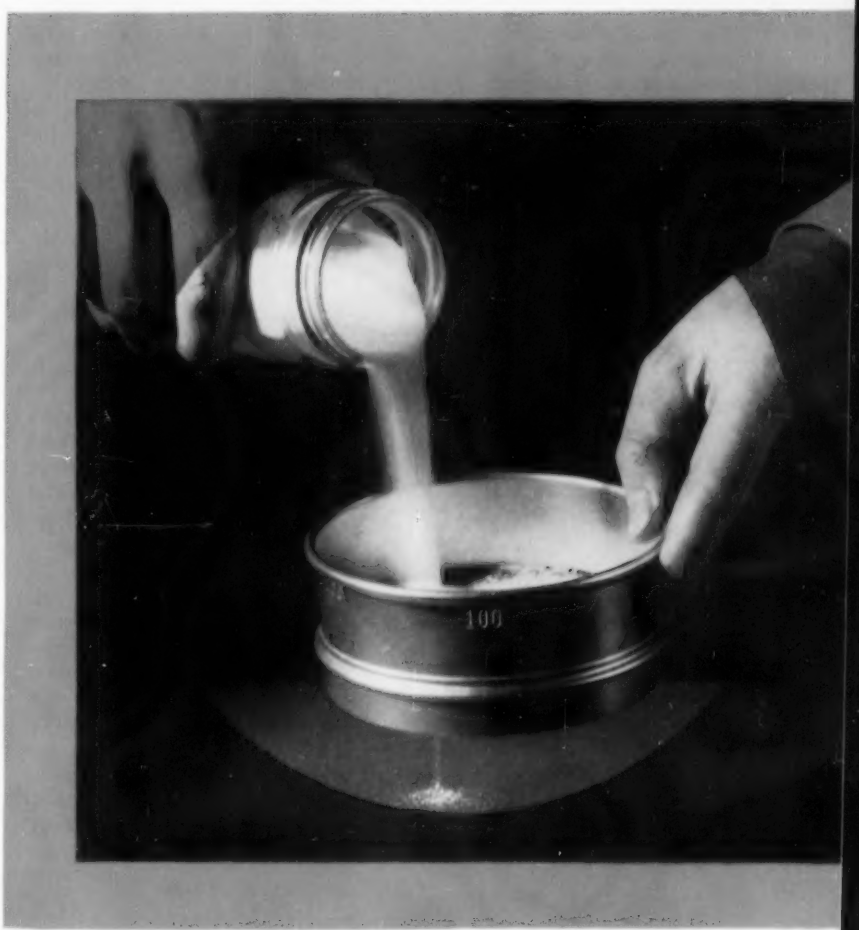

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New Machinery and Equipment

Self-feed panel saw

This panel saw accurately rips plastics, plywood, and fiber sheets up to 48 in. wide in any length. The saw arbor can be arranged for either single cuts with direct motor drive or for multiple ripping and grooving. The feed mechanism of the saw is equipped with individually adjustable, rubber-covered steel feed rolls, turning in self-aligning, sealed ball bearings, and is powered by a separate variable-speed motor. *Gaynes Eng. Co., 1642-52 W. Fulton St., Chicago 12, Ill.*

Extruders

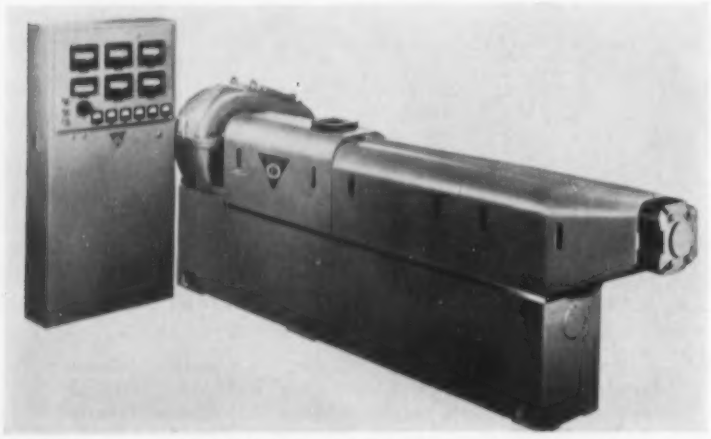
The Model 57 extruder, offered in sizes ranging from 2.5 to 8 in. in screw diameter and lengths of 16, 20, and 24 times the diameter, incorporates several features designed to give greater outputs, closer temperature control, and longer service. It has a highly efficient, V-belt-driven, herringbone-gear transmission, an extra-heavy, ball-type thrust bearing, and a flexible coupling between the transmission and the shaft to protect the transmission against shock. Normal motor powers range from 15 hp. on the 2.5-in. machine to 100 hp. on the 8-in. machine. Full horsepower is maintained down to about half of full speed, an unusual feature, and can be extended to other speed ranges by changing pulleys on the belt drive.

Control of temperature is fully automatic, with 3-position electronic controllers that actuate stainless steel heaters and air blowers. Low temperature gradients and minimizing of heat surges are accomplished by having the heaters supply heat about two-thirds of the time. *Prodex Corp., Fords, N. J.*

Vacuum forming machine

The "Star," one of the Comet line of sheet forming machines, has two opposed platens, each of which can carry a mold or molding helper. Designed primarily for items hard to fabricate because of their shape or the thickness of material, the counteracting platens provide for "plug-assist" or "holdback-directing" control during forming. Vacuum may be applied through either or both platens at the same time. The heater consists of an enclosed oven that may be heated by gas, oil, or electricity. The sheet is heated on both sides to speed up heating and improve uniformity of sheet temperature. The heated sheet is automatically withdrawn from the oven, clamped between the two platens and formed on an automatically timed cycle. The machine may be loaded and unloaded by hand or automatically. It is available in four standard sizes with mold areas ranging from 3 by 4 to 5 by 8 feet. *Comet Industries, 9865 Franklin Ave., Franklin Park, Ill.*

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by MODERN PLASTICS.



Prodex extruder Model 57 has a screw diameter of 4.5 in. and a screw length of 20 diameters; provides close temperature control

Foam dispenser

Nopcometer, an automatic metering, mixing, and dispensing unit, is said to make possible mass production rates and control in the application of cellular foamed plastics. It was especially developed for use in conjunction with the Lockfoam series of foamed-in-place plastics. The machine can deliver to the production line, automatically and intermittently, a preset charge of foam of any desired density at rates up to 15 lb./min. This completely eliminates the hand measuring, mixing, and pouring into place of foams. *Nopco Chemical Co., Harrison, N. J.*

2-oz. injection machine

A fully automatic vertical injection molding machine with a nominal 2-oz. shot rating, the Stokes Model 701, is the first machine to combine vertical clamping with a horizontal combing action. Degated parts can be ejected horizontally onto a conveyor instead of being dropped into bins. This feature reduces the danger of damaging the surfaces of the molded products. Guides can be constructed to sort the separate pieces (and the sprues and runners) from a family mold into separate bins. Either top or bottom ejection is possible and the knockout cylinders are hydraulically operated independently of the injection ram.

Positive shut-off at the injection nozzle is provided, making

MODEL
H-250

Step Up Production with VAN DORN 2½ Oz. Automatic Press

Check these outstanding features of this ultra-modern Van Dorn injection press:—

GREATER CAPACITY— Up to 2½ oz.; smaller pieces at faster cycles.

HI-SPEED PERFORMANCE— Plasticizes material at 22 lbs. plus per hour.

FASTER PRODUCTION—Will attain up to 720 cycles per hour (dry run).

HIGHEST EFFICIENCY—Due to water cooling of injection plunger, transfer hopper and oil cooler.

ACCESSIBILITY— Due to simple platen clamp device for purging to change material or color.

MORE SAFETY— Mold hydraulic mechanism makes press non-operative unless molded part is completely ejected.

SIMPLER OPERATION—Due to automatic, adjustable material metering device.

MULTIPLE OPERATIONS— Minimum operator attention by use of larger hopper and light that indicates when press needs attention.

SELECTIVE CONTROL—Merely throw toggle switch to operate press semi-automatically.

DEPENDABILITY— Because of all-steel construction and Van Dorn's established reputation in the plastics machinery field.

THE VAN DORN IRON WORKS CO.
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2-oz. capacity.

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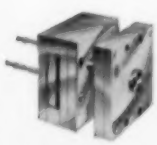
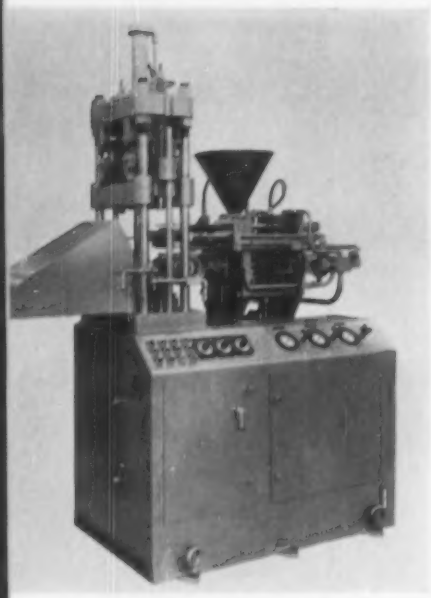
2-oz. and 1-oz. models

PLASTIC GRINDER
Grinds up rejects, waste, etc., for re-use.



MOLD BASES
Available from stock.



Stokes 2-oz. injection machine combines vertical clamping with automatic degating and ejection of pieces as well as runners

it easier to mold nylon, and making it possible to pre-pack the cylinder at full pressure before injection. Cycles as short as 3.5 sec. are possible.

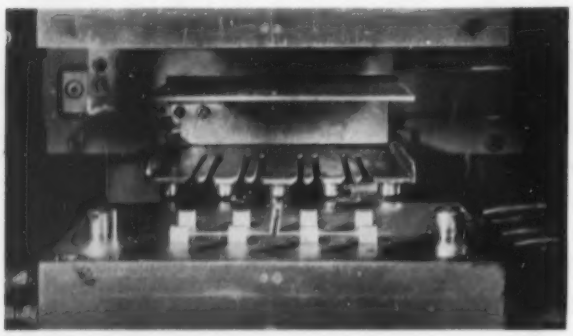
The model 701 is said to be a "completely self-contained molding plant" and requires only 18 sq. ft. of floor space. Since degating, ejection, and sorting are automatic, one operator can handle as many as ten of these machines. Every step in the molding cycle is automatically controlled and the operator merely loads the feed hopper and removes the finished pieces in bulk. If there is an interruption of the cycle, the machine stops until the fault is corrected and the operator restarts the machine. The molds are protected against damage during closing. Specifications are:

Capacity	2 oz.
Injection pressure	11,300 p.s.i.
Plasticating capacity	30 lb./hr.
Dry-cycle time	3½ sec.
Top clamping force	50 tons
Clamping stroke	5½ in.
Daylight opening	17 to 23 in.
Molding area	11 by 8 in.
Motor	7½ hp.
Cylinder heaters	2.5 kw.
Floor space	39 by 66 in.
Height	97 in.
Weight	4500 lb.

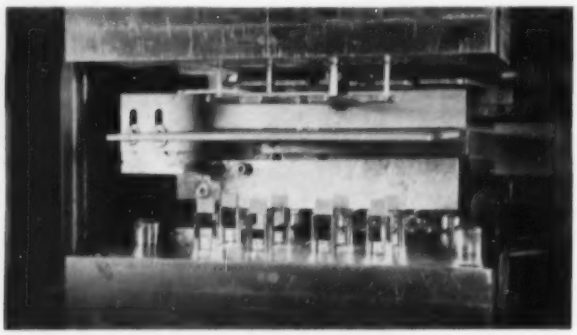
F. J. Stokes Machine Co., Inc., 5500 Tabor Rd., Philadelphia 20, Pa.

Cold-curing vacuum bags

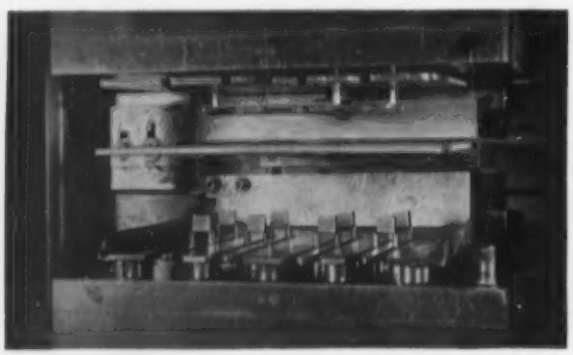
Molded rubber blankets or bags of virtually any contour for use in vacuum-bag molding of reinforced laminates are now being made by preforming the bag material on the mold and curing it at low temperatures. Previously, the high temperatures needed to cure conventional bags often resulted in damage to molds. Fabricating bags of already cured rubber has been tedious and ex-



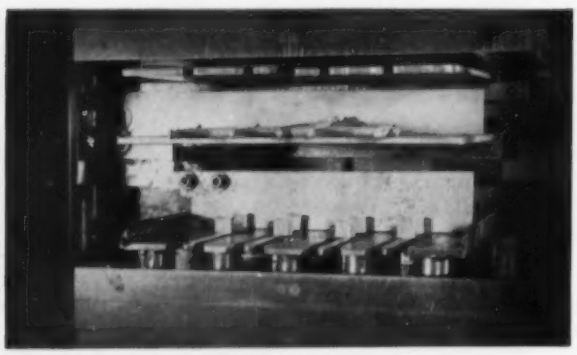
Mold of 2-oz. machine just after opening. The square degated parts are in lower half; runner (out of sight) is still in upper half; piece sweeper is fully retracted over comb



Embedded knockout pins positively eject parts and runner. The upper and lower vertical sweeper plates and the shelf that catches the runner have advanced part of the way



Upper and lower combs advance to their "combing" position. Next, they will be withdrawn, leaving molded pieces standing on lower comb while runner falls to shelf at middle level



Sweepers advance to slide pieces and runner onto separate conveyors. At end of this operation, sweepers and combs withdraw so that the mold can close for the next shot

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Have you investigated *new* Isophthalic? Your competitors are discovering from it product properties heretofore unobtainable. To give your finished products new sales advantages, it will pay you to evaluate Isophthalic now in your own laboratory. Contact the Oronite office nearest you for further information.

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Greater plasticizing efficiency

Higher molecular weights in polymeric plasticizers

Lower volatility

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pensive and has left seams which were reproduced in the product. The new low-temperature-cured bags are ready for use in a fraction of the time formerly required. They are less expensive, they last longer, they hold their shapes well, and will withstand temperatures up to 240° F. They are easily repaired by cold patching. To make these bags, the manufacturer asks that the specific molds be shipped to Philadelphia for perfect alignment; where this is not practical, the job can be done at the customer's location. The new bag-making technique should make possible the vacuum-bag molding of many products that have formerly been pressure molded. *Quaker Rubber Div., H. K. Porter Co., Tacony and Comly Sts., Philadelphia 24, Pa.*

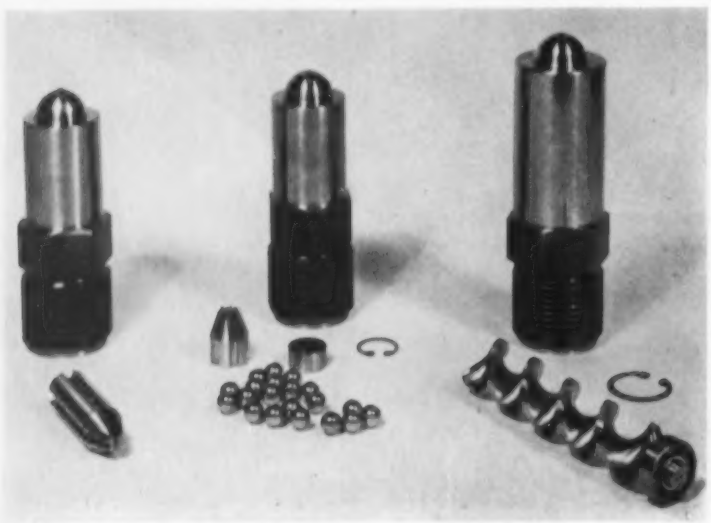
Heated injection nozzles

Four extension nozzles, each of different design, provide both a mixing action and an extra heating area. In each, the larger-than-usual bore is fitted with one of four kinds of insert: 1) a pineapple-type spreader, 2) twenty ⅜-in. stainless steel balls, 3) a tiny, free-wheeling extruder screw, or 4) a miniature polyliner (see MODERN PLASTICS *33*, 109, Feb. 1956). The last three are shown in the illustration. The screw insert is mounted on a stainless steel ball-bearing race that is seated in the *forward* end of the nozzle.

The principal result of all four designs is to provide more area of contact between the melt being injected and the heated nozzle. This tends to add to the heating capacity of the cylinder, but, even more important, it helps to level out point-to-point differences in temperature in the melt stream entering the nozzle. This levelling of differences is also helped by the intermixing action of the nozzles, particularly of the polyliner and ball types. Complete fusion of granules is assured without excessive pressure drop across the nozzle. The nozzle lengths average about 5 in. overall and they can be used with all cylinders having front openings ¾ in. or larger. The effective use of these nozzles requires that they be equipped with individually controlled, high-wattage heater bands. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Spray painter

Especially designed for spray painting cylindrical and rectangular parts such as tubes, bottles, model trains, etc., an air-operated automatic machine has vertically traveling guns which can spray either on their downstroke or on both the down- and upstrokes. A rotatable spindle that holds the work may be turned at speeds ranging from 50 to 400 r.p.m. or may be held still; it can be braked to a stop quickly to speed loading and unloading of work. The speed of travel of the two spray guns is also adjustable. The unit, known as the Model SS2GVT, is fitted with all necessary controls, hoses, and connections. *Conforming Matrix Corp., 364 Toledo Factories Bldg., Toledo 2, Ohio.*



IMS extension nozzles provide extra heating area and mixing action. The nozzles incorporate respectively (left to right) miniature polyliner, twenty ⅜-in. stainless steel balls, and helical insert

Hydraulic cylinder mountings

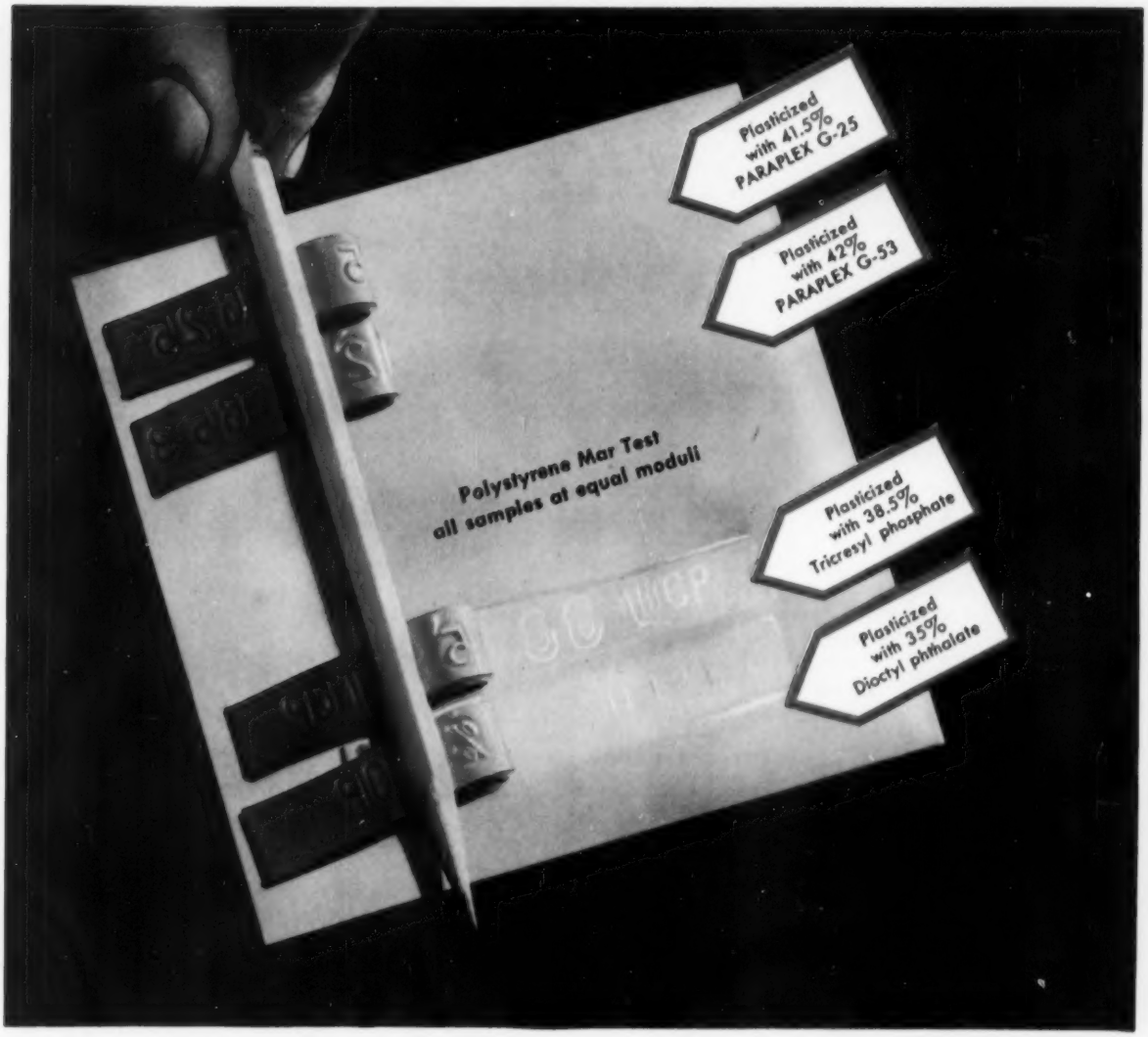
Correct alignment between cylinders and their work loads has been a constant headache to industry. Two new universal-type mountings solve this problem and reduce the costs created by breakage. The mountings are available in two forms: 1) a hinged mount with universal brackets for both piston and cylinder, 2) a universal trunnion for the cylinder with a universal mounting bracket for the piston. Such cylinders are commonly used to operate hopper gates, machine elements, etc. *Hanna Engineering Works, 1765 N. Elston Ave., Chicago 22, Ill.*

Heat sealer

The Sealomatic Model 350, a 3.5-kw. electronic heat sealing machine, is built with components rated for 4-kw. service to assure the user full power output at all times. This "reserve power" feature increases reliability of operation and machine life. If desired, a device that suppresses arcs will be furnished as an extra material- and machine-saving feature. *Sealomatic Electronics Corp., 429 Kent Ave., Brooklyn 11, N. Y.*

Bench-model extruder

A self-contained vertical extruder, the Reed Autoflow 20V, differs from current bench models in its vertical construction and in its built-in "material dryer," take-off equipment, and water bath. It requires only a 1-hp. motor to extrude its rated capacity of 20 lb./hr. The vertical screw extends upward into the hopper, keeping the granular material in motion, assuring even feeding, and eliminating bridging. After the feed has been conveyed downward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Plasticized with 42% PARAPLEX G-53
Polystyrene Mar Test all samples at equal moduli
Plasticized with 38.5% Tricresyl phosphate
Plasticized with 35% Dioctyl phthalate

Cut down plasticizer migration with PARAPLEX G-53

The test illustrated here clearly shows why polymeric plasticizers such as PARAPLEX G-25 and PARAPLEX G-53 are recommended for use in vinyl compounds which contact polystyrene, lacquers, rubber, and baked finishes.

Take polystyrene for example. Widely used in refrigerators and other appliances, polystyrene is often severely marred by vinyl gaskets containing so-called fugitive plasticizers. When PARAPLEX G-25 or PARAPLEX G-53 is used, migration is drastically reduced and the appearance and physical properties of the polystyrene are virtually unaltered.

PARAPLEX plasticizers provide many other benefits, too. PARAPLEX G-53 is highly resistant to extraction by soaps, detergents, and hydrocarbons. It is extremely non-volatile. And its cost is quite moderate. High molecular-weight PARAPLEX G-25 has all of the physical properties of PARAPLEX G-53—and more.

For more information on *all* of the plasticizers produced by Rohm & Haas Company, ask for *What You Should Know About* PARAPLEX *and* MONOPLEX *Plasticizers.*

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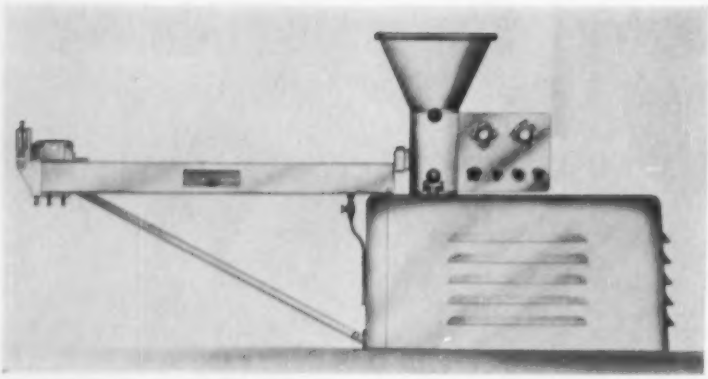

Reed-Prentice vertical extruder, Autoflow 20V, has built-in material preheater, take-off equipment, and water bath

along an unheated section of the barrel, it reaches a zone heated by electric bands. It is plasticated and "folded backwards" as it meets reversed-pitch flights. The resulting build-up of pressure forces the hot melt out through the die.

Because of the vertical arrangement, heat normally wasted is used to preheat the material in the hopper. Air is forced downward through the hollow screw; after picking up heat from the screw, it flows upward through small ports in an agitator cap at the top of the screw and through the feed material. By keeping small the area in which plastication is accomplished the thermal hazard is said to have been reduced, thus making the machine especially gentle in its treatment of heat-sensitive materials. Means are provided to vary speeds and heater wattages. By opening two cam locks which clamp the barrel, the entire mechanism can be lifted off for cleaning. *Reed-Prentice Corp., Worcester 4, Mass.*

Feeder controls ram position

A new weigh feeder operates on the principle that the important factor to control in an injection machine is the ram position at the end of the injection stroke. By doing this in spite of variations in line pressure, stock temperature, etc., the feeder automatically maintains a constant "cushion" of stock between the ram and the melt zone. The plunger is bottomed on each shot. This is said to eliminate packing, molded-in stresses, and flashing. Higher injection pressures can be used to get faster filling without danger of flash because shot volume is controlled. The new feeders have hopper capacities of 100 lb. of powder and have weigh buckets of either 32- or 50-oz. top capacity. *Exact Weight Scale Co., 944 W. Fifth Ave., Columbus, Ohio.*

Tubular radiant heaters

The RHE tubular radiant heater is especially designed for heating cylindrical extrudates such as wire coatings, hose, etc. The temperature of the radiating surface can be varied from 200 to 1000° F. and can be held to within ±5° with good uniformity over the entire surface. The heaters are hinged for convenience and are wired for operation on any voltage. They come in lengths of from 2 to 6 ft. with core diameters from 3 to 10 inches. Made of stainless steel and thoroughly insulated, they permit processing at rates of 6 to 8 times those obtainable with heating by convection. They may be used in gangs to attain any desired throughput. *Radiant Heat Enterprises, Inc., 630 Morris and Essex Tpke., Short Hills, N. J.*

Laboratory presses

Presses of a new line designed to meet the exacting requirements of laboratory work have platens made of a special alloy that is both hard and highly heat conductive. The electrical heating elements of each platen are controlled by a Fenwal 560 indicating proportional controller. The combination of highly conductive platens and proportional control gives very close regulation of temperature. The presses are available with platen sizes ranging from 8 to 18.5 in. square and with ram capacities from 20 to 125 tons. *Pasadena Hydraulics, Inc., 273 North Hill Ave., Pasadena, Calif.*

Small vacuum forming machine

The Lab-Vac is a low-cost table-model vacuum forming machine well suited to the test-forming of new shapes and to experimenting with skin packaging. The maximum forming area is 16 in. square. The machine is equipped with a drape mechanism with a 7-in. stroke, high-temperature heater, vacuum pump, reservoir tank, and clamping frame. *Auto-Vac Co., 1986 State St. Ext., Bridgeport 5, Conn.*

Large-area bench oven

The model 333 bench oven has a 3-cu. ft. working space that can be used as a whole or subdivided by shelves spaced as closely as 3 in. apart. Electrically heated to provide temperatures ranging from 100 to 350° F., it is available for 220-v., single-phase sources and for 220/3, and 440/3 sources. The oven is built of heavy-gage steel, insulated with 2 in. of fibrous glass, with heating elements sheathed in Inconel. A circulating fan assures uniformity of temperature. The oven is furnished with a pilot light and a non-indicating temperature controller. An indicating controller is optional. *Grieve-Hendry Co., 1401 W. Carroll Ave., Chicago 7, Ill.*

Anti-static process

The Katharon process is said to virtually eliminate static electricity in unsupported calendered Polyethylene film and sheet. Up to now, static charge has been a deterent and nuisance in fabricating and merchandising the film and film products. Katharon-processed film attracts almost no dust, and is now available in commercial quantities. Samples of and information on processed film may be obtained from *Ross and Roberts Co., 350 Fifth Ave., New York 1, N. Y.*

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Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Plastics in the Service of Man"

By V. E. Yarsley and E. G. Couzens

Published in 1956 by Penguin Books Ltd., Harmondsworth, Middlesex, England. 315 pages. Price: 3/6 (ca. 50¢).

This pocket-size book surveys the uses to which plastics materials are being put. Since, however, as the author points out, it is difficult to understand the behavior and origin of plastics without some knowledge of their basic chemical structure, an attempt has been made to describe this structure in simple terms, and to indicate the various raw materials from which they are derived. Their contemporary use for domestic and industrial purposes is detailed at some length; in conclusion, some assessment is made of the importance of plastics in current world economy, and the almost inexhaustible possibilities for their future development.

"British Plastics Yearbook, 1956"

Published in 1956 by Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E. 1, England. 740 pages. Price: 35s (ca. $5.00).

The 26th edition of this classified guide to the British plastics industry is divided into nine sections. Three are devoted to classified lists of manufacturers and suppliers of materials, finished products, and equipment. A section contains a list of trade and proprietary names connected with the plastics industry, including a glossary of technical terms used in connection with plastics. Another section lists nearly 4000 firms associated with plastics, grouped into countries. The "Who's Who" section gives names and positions of prominent people in the industry. The annual review of plastics patents arranged according to subject groups, is included. New plastics companies registered last year are listed. In addition, the handbook provides technical and general data, specifications relating to plastics, and other useful information.

"The Chemistry of Phenolic Resins"

By Robert W. Martin

Published in 1956 by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. 298 pages. Price: $9.50.

Subtitled "The Formation, Structure, and Reactions of Phenolic Resins and Related Products," this book is said to be "the only detailed survey in English to cover both the chemistry of present-day phenolic resins and the chemistry of the related products which are available as more or less pure compounds." There are nine profusely documented chapters, plus an introduction. There are no details of the methods and equipment used in the commercially important reactions discussed, but a thorough exposition of the chemistry is given. Each chapter ends with a list of from 74 to 213 pertinent references. A 23-page index provides a handy guide to subject matter.

"Simposio Internazionale di Chimica Macromolecolare"

(International Symposium on Macromolecular Chemistry of the International Union of Pure and Applied Chemistry held at Milan and Turin from 26 Sept. to 2 Oct., 1954).

Published in 1955 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 954 pages. Price: $19.20.

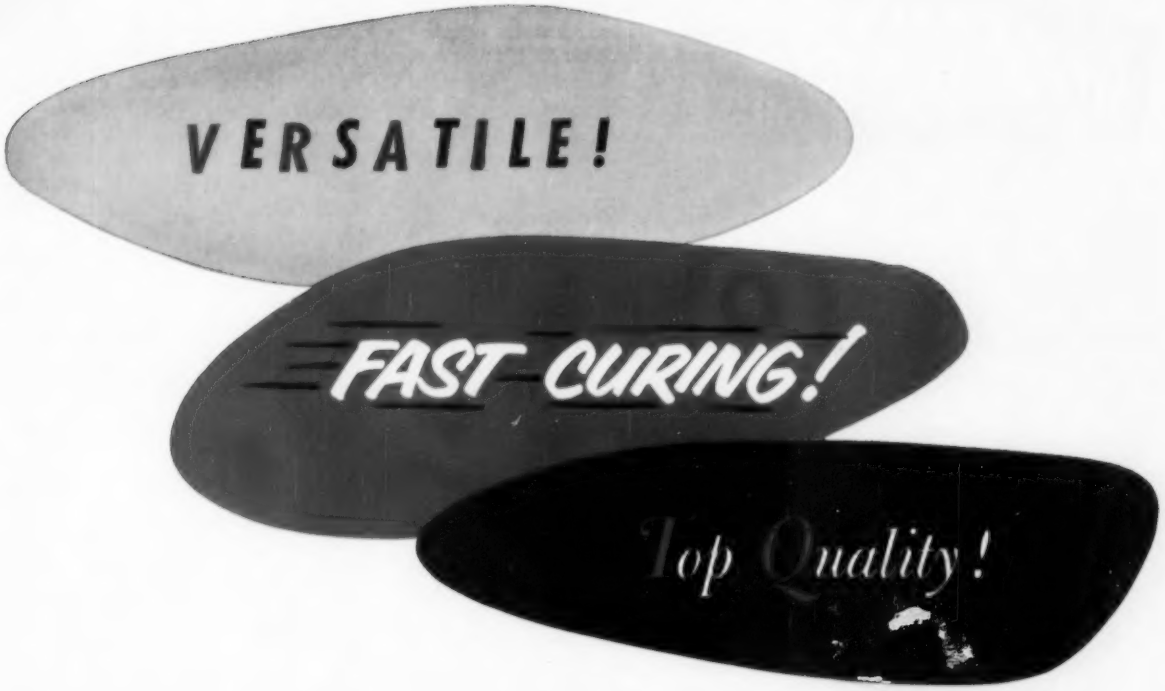
The papers presented at the Milan meeting are presented first, the Turin papers next in this impressive tome. All titles are first listed in the language of the author—English, French, German, Italian—and then in the other three. At the end of each paper, the opening summary is printed in the other three languages; these summaries run between 50 and 500 words, usually about 250. Of the 95 papers printed, 45 are in English. Seven are presented in summary only. The Milan papers are divided into four groups: 1) formation reactions of macromolecules, 2) transformation reactions of macromolecules, 3) block polymers and graft polymers: preparation and properties, and 4) cellulose and derivatives.

The Turin papers are in seven groups: 1) molecular-weight distributions, 2) methods for determining molecular weights, 3) branched polymers, 4) fiber-forming high polymers, 5) crystallization and transitions, 6) proteins, and 7) general properties of polymers. The only index is an alphabetical list of the authors.

Reference for plastics. The 1956 edition of "A Ready Reference for Plastics" is a well prepared manual which presents brief descriptions of the properties, applications, characteristics, advantages, disadvantages, forms, government specifications, tradenames, etc., of the most commonly used plastics materials. One section deals with the organic chemistry of plastics; another is composed of charts, tables, and formulas designed to provide fast answers to a variety of every-day questions. 123 pages. Up to four copies available free on letterhead request. Over four, $2.00 each. *Boonton Molding Co., Boonton, N. J.*

Instruments. Bulletin F-5228-3 presents information on thermocouples, radiation detectors, resistance bulbs, and other accessories for indicating, controlling, and recording instruments used in the plastics and other industries. Conversion tables, specifications, characteristics, and prices are included. 40 pages. *Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.*

Reinforced plastics. The ability of fibrous glass-reinforced plastics to resist acids, alkalies,



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salts, gases, and other chemicals at different temperatures are discussed in Bulletin 56. Sixty-six of the most commonly encountered elements and compounds are covered. 4 pages. *Modular Plastics Corp., 1635 Westminster, Detroit, Mich.*

Destaticizers. Bulletin No. 3 describes a line of destaticizers for use with a variety of plastics materials. They may be applied by the dip, wipe, spray, or brush method. *Merix Chemical Co., 1021 E. 55th St., Chicago 15, Ill.*

Valves and fittings. This circular describes a line of valves and fittings molded of corrosion-resistant polyvinyl chloride. Advantages, installation data, and dimensions are given. *Lunkenheimer Co., Cincinnati 14, Ohio.*

Ethers and oxides. Booklet F-4764 discusses the applications of 32 products, including ethylene oxide and propylene oxide, in the manufacture of surface coatings, cleaning compounds, photographic films, dyes and wood stains, etc. Physical properties, solubilities, specifications, test methods, and constant boiling temperatures are given. *Carbide and Carbon Chemical Co., 30 E. 42nd St., New York 17, N. Y.*

Rotary tablet machines. Bulletin 650 describes two rotary tablet machines. Advantages, performance specifications, and physical dimensions are given. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Destaticizers. Bulletin describes a destaticizer for polyethylene and lists eight properties the product will impart to polyethylene in addition to antistatic. *Alframine Corp., 4731 E. 52nd Drive, Los Angeles 22, Calif.*

Dinnerware. Booklet describes uses, method of manufacture, and advantages of melamine dinnerware. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

N-hexanol. Technical bulletin discusses n-hexanol, an intermediate for the manufacture of caproic acid, pharmaceuticals, detergents, and plasticizers, and gives data on its physical and physiological properties, specifications, shipping, resin solubilities, and constant boiling mixtures. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Liquid stabilizers. Bulletin gives specifications, chemical composition, descriptions, and recommended uses with vinyls for a line of liquid stabilizers. *Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, Ohio.*

Anti-corrosion tapes. Catalog gives information on anti-corrosion polyethylene tapes used in the protection of underground pipelines and in above-ground installations. Methods of application to pipe, specifications, surface preparations, taping and wrapping, inspection, repair, etc., are discussed. *Kendall Co., Polyken Sales Div., 222 W. Adams St., Chicago 16, Ill.*

Adhesives. Structural epoxy-based adhesives designed for general- and special-purpose bonding of rigid materials such as plastics, metals, glass, ceramics, and hard rubber, are described in technical literature. *Leffingwell Chemical Co., Perry Annex, Whittier, Calif.*

Styrene containers. Catalog sheet describes a line of re-usable styrene containers for stimulating retail sales. Advantages, sizes, and characteristics are given. *Hi-Pak, Inc., 3135 W. Grand Ave., Chicago 22, Ill.*

Reinforced plastics. Bulletin BSB-143 points out salient facts and sources of information helpful in planning industrial manufacturing, marketing, and packaging programs involving fibrous glass-reinforced plastics containers. 10¢. *U. S. Dept. of Commerce, Washington 25, D. C.*

Melamine. Technical information handbook describes general and specific characteristics of melamine molding compounds, storage and handling, molding

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procedures and variables, design of molded parts, and other factors in successful molding. *American Cyanamid Co., Plastics and Resins Div., 30 Rockefeller Plaza, New York 20, N. Y.*

Wood publications. Report No. 1630, presents a simplified method of calculating the strength and stiffness of plywood and suggests working stresses for use by engineers who design structures with Douglas-fir plywood. 6 pages. Another report, No. RPI-4, lists more than 250 available publications on the physical properties of paper-plastic laminates, plastic laminates, wood, plywood, veneer, laminated wood, modified wood, and structural sandwich construction. 13 pages. *U. S. Forest Products Laboratory, Madison 5, Wis.*

Room temperature bonding. This reprint of an article that appeared in MODERN PLASTICS Magazine emphasizes epoxy-based adhesives which need neither heat nor pressure for curing. Charts, tables, data on "strength vs. temperature," "cost of heat resistance," etc., are included. 8 pages. *Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.*

Liquid springs. Utilizing the high compressibility of especially formulated silicone liquids, Taylor liquid springs, described in Catalog LS, can replace conventional metal coil springs with a 10-fold saving in space. Compression, extension, and combination types, as well as shock absorber types are described. *Taylor Devices, Inc., 188 Main St., North Tonawanda, N. Y.*

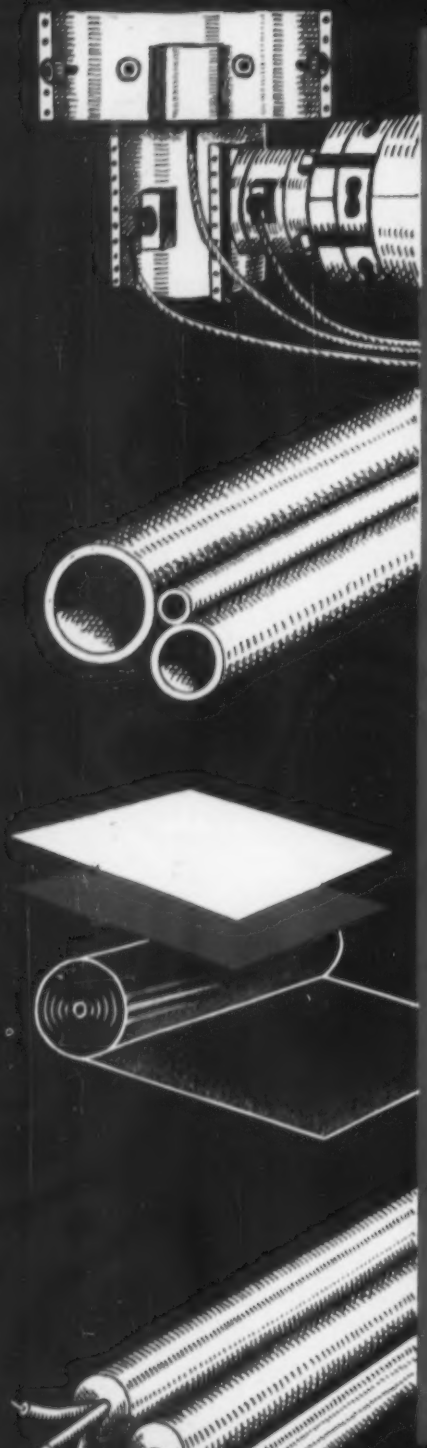
Applicator rolls. A reference table for determining the amount of dry solids in solution (plastics, color, or adhesive) which will be applied by various types and depths of applicator rolls provides a guide for individuals in the plastics, printing, and packaging industries. Advantages of electronic controlled precision engraved applicator rolls and facilities for roll production are discussed. 2 pages. *Modern Engraving & Machine Co., 1413 Chestnut Ave., Hillside 5, N. J.*

Injection machine. Bulletin describes operating principles and lists specifications for a preplasticating-type injection molding machine. Accessory equipment, design, machine speeds, and die space dimensions are also presented. See MODERN PLASTICS *33*, 194 (Apr. 1956). 6 pages. *Watson-Stillman Press Div., Farrel-Birmingham Co., Inc., 109 Alden Rd., Roselle, N. J.*

Tools. Catalog MC-902 describes a line of carbide-tipped tools, chromium-processed saw blades, etc., used in the plastics, wood, and metal working industries. Sizes, prices, etc., are given. 14 pages. *Price & Rutzebeck, 22150 Meekland Ave., Hayward, Calif.*

Injection molding. Booklet covers molding process, choice of material, product design, injec-

(*To page* 176)



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The drive is effected by a self- and externally-cooled commutator A. C. shunt-wound motor, with infinitely variable controllable speeds . . . two screw speed ranges . . . all rotating parts run in ball bearing races . . . lubricating oil is circulated under pressure by a special gear pump, and a magnetic filter purifies the oil of both metallic and non-metallic impurities.

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Infinitely variable by means of AC Shunt-motor	
Speed Position I	9 - 34 r. p. m.
Speed Position II	17 - 63 r. p. m.
Motor for Screw	
Standard	30 h. p.
Special	38 h. p.
Output	
of Extruder (working averages)	88-265 lb/H

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tion machines, mold design, finishing, etc., for acetate and

tected outdoor exposure for five to ten years. 4 pages. *The Borden*

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111 Eighth Ave. NEW YORK 11, N.Y.

polystyrene, and polyethylene plastics are covered in detail, and

tion machines, mold design, finishing, etc., for acetate and butyrate. Schematic diagrams, sectional drawings, and a trouble shooting chart are included. 51 pages. *Eastman Chemical Products, Inc., Kingsport, Tenn.*

Ferromagnetic plastics. A set of bulletins describe ferromagnetic plastics materials both in flexible rod and tape, and rigid powdered-iron cores. Physical and magnetic properties are presented in graph form, and specifications and prices are given. 12 pages. *Polyplenco, Inc., a subsidiary of The Polymer Corp., 2150 Fairmont Ave., Reading, Pa.*

Woodworking adhesives. Bulletin 72a covers durability tests performed on woodworking adhesive specimens made in 1939. The reported results are a continuation of tests on plywood aged 10 to 16 years under various exposure conditions. Also covered are comparisons of various types of adhesives on different veneer species under continuous unprotected outdoor exposure for five to ten years. 4 pages. *The Borden Co., Chemical Div., 350 Madison Ave., New York 17, N. Y.*

Industrial motion picture. A new 16-mm., color and sound film, "Tracer Control in Action," was photographed under actual shop conditions. It portrays the uses of a line of pantographs and duplicators in profiling, milling, and engraving operations. The film is available free on a loan basis on letterhead request; user pays return special delivery postage. Reservations should be made from 4 to 6 weeks in advance. *George Gorton Machine Co., 1321-AA Racine St., Racine, Wis.*

Production planning. Techniques of planning and control are described by various men directly concerned with production in their respective companies in Special Report No. 5. Most of the book is based on papers and supplementary material prepared for the special conference on production forecasting, planning, and control held by AMA's Manufacturing Div. Some of the subjects covered are: Organizing for Maximum Results; Factors in a Successful Program; Contributing Groups and Individuals; and Company Programs and Approaches. 202 pages. $5.50 for non-members; $4.00 for members. *American Management Association, Inc., New York 36, N. Y.*

Color. "Color Comes of Age" explains what color is, how new colors are discovered, and how color can be applied to different materials with a view toward design, engineering, and marketing. 12 pages. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Explaining plastics. A pocket-size booklet describes the production of plastics and plastics products from natural resources. It contains basic facts on the sources of plastics, their spectacular growth, and their importance in everyday living. Phenolic, vinyl,

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polystyrene, and polyethylene plastics are covered in detail, and polyester, epoxy, fluorethene, and silicone plastics are described as the latest plastics to come from the laboratories. Qualities, uses, origins, etc., are given in tabular form. 48 pages. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Fusing, drying, curing. Bulletin presents specifications, advantages, dimensions, and production information for a line of equipment used for fusing, drying, and curing such materials as vinyl, nylon, cloth, paper, jute, fibrous glass, impregnated paper, etc. 16 pages. *F. C. Dawson Engineering Co., 641 Washington St., Canton, Mass.*

Textile research. The 1955 Annual Report of the Textile Research Institute discusses, among other things, research done on various cellulose fibers. 43 pages. *Textile Research Institute, Princeton, N. J.*

Het anhydride. General properties, typical reactions, and suggested uses are given in Bulletin 43 for Het anhydride, a chemical used as a hardener or curing agent for liquid epoxy resins. 17 pages. *Hooker Electrochemical Co., Box 344, Niagara Falls, N. Y.*

Safety headgear. Bulletin 45 describes a line of fibrous glass-reinforced polyester resin safety hats and caps, which incorporate polyethylene inner suspensions to make them adjustable to any head size. 2 pages. *The Fibre-Metal Products Co., Chester, Pa.*

Coils. Bulletin 355 describes coils, consisting of two seam-welded sheets of metal, embossed to form channels, for use in industrial heating and cooling. In addition to giving advantages, suggested applications, specifications, and conversion tables, the following subjects are covered: operating pressures, heat transfer coefficient, pipe coil comparison method, wall and surface losses, material load, pressure drop, etc. 52 pages. *Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N. Y.*

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AVERY PRESSURE-SENSITIVE LABELS

Avery pressure-sensitive Labeling offers you a new approach . . . an easier and *better* solution . . . wherever you need to code, identify, instruct, warn, route or inspect. It's the modern low-cost method of labeling to do the job quickly and efficiently. Avery Labels can be designed and produced in the exact size, shape and color you need . . . individually die-cut on sheets or rolls for manual or automatic labeling!

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One simple motion—a fingertip pressure—and Avery Labels are on in an instant—*without* moistening! No waste motions in handling or sorting loose labels—no messy gluing or wetting.

2. STICKS TO ANY CLEAN, SMOOTH SURFACE

Metal, plastic, glass, cellophane, metallic paper, pliofilm, polyethylene, ceramics, wood . . . and many other surfaces . . . are being easily and quickly labeled every day with Avery pressure-sensitive Labels.

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Will not pop, peel or curl even under extremes of temperature and humidity—even stay neat and attractive with rough handling.

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In all industries . . . in hundreds of ways . . . Avery Labels are saving time, labor and money every day. Avery Labeling is geared to *your own* type of operation—either fast, production line speed or intermittent labeling.

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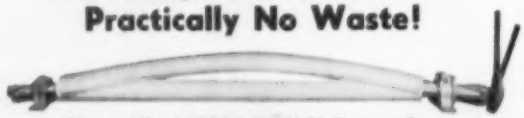

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Originator of modern expanders—leader in handling equipment for all types of fabrics.

MOUNT HOPE MACHINERY COMPANY

180 FIFTH STREET, TAUNTON, MASS.

mp Plastics

Production and sales figures in 1000 pounds* for February and March 1956

Materials	*Total p'd'n first 3 mos. of 1956‡*	*Total sales first 3 mos. of 1956‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	5,009	4,907
Sheets, 0.003 gage and over	4,159	3,878
All other sheets, rods, tubes	2,061	1,893
Molding, extrusion materials	21,677	21,450
Nitrocellulose sheets, rods, tubes	1,517	1,468
Other cellulose plastics	1,439	1,246
Phenolic and other tar-acid resins:		
Molding materials[a]	60,345	51,279
Bonding and adhesive resins for:		
Laminating (except plywood)	17,422	12,281
Coated and bonded abrasives	4,237	4,164
Friction materials (brake linings, clutch facings, etc.)	5,768	4,962
Thermal insulation	14,530	14,239
Plywood	11,579	9,335
All other bonding uses	8,090	7,862
Protective-coating resins	7,945	7,097
Resins for all other uses	8,167	7,267
Urea and melamine resins:		
Textile-treating resins	13,851	12,347
Paper-treating resins	6,121	5,809
Bonding and adhesive resins for:		
Plywood	27,333	24,531
All other bonding and adhesive uses, including laminating	7,475	6,132
Protective-coating resins	9,383	6,756
Resins for all other uses, including molding	23,299	21,913
Styrene resins:		
Molding materials[a]	105,755	101,998
Protective-coating resins	26,324	24,637
Resins for all other uses	24,919	25,596
Vinyl resins, total[b]	195,172	180,804
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		20,778
Sheeting (resin content)		15,504
Molding and extrusion (resin content)		50,316
Textile and paper treating and coating (resin content)[c]		16,325
Flooring (resin content)		15,090
Protective coatings (resin content)		6,355
All other uses (resin content)		18,581
All other vinyl resins for:		
Adhesives (resin content)		9,211
All other uses (resin content)		28,688
Coumarone-indene and petroleum Polymer resin:	61,935	60,337
Polyester resins:	16,832	13,507
Polyethylene resins:	124,704	120,633
Miscellaneous:		
Molding materials[a, d]	11,427	10,163
Protective-coating resins[e]	2,204	1,223
Resins for all other uses[f]	29,419	27,216

* Dry basis designated unless otherwise specified.
† Revised. ‡ Partially estimated.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

February†		*March‡*	
Production	*Sales*	*Production*	*Sales*
1,621	1,655	1,901	1,790
1,206‡	1,143	1,639	1,535
598‡	623	756	684
7,178	6,959	8,007	8,078
497	467	501	487
501	450	488	468
20,279	16,620	20,351	17,024
5,223	3,914	6,218	4,454
1,409	1,303	1,318	1,388
1,891	1,635	1,936	1,735
4,646	4,783	4,711	4,668
4,040	3,234	4,060	3,255
2,592	2,359	2,772	2,783
2,624	2,255	2,578	2,347
2,719	2,429	2,566	2,274
5,507	5,508	4,081	2,633
2,465	2,006	1,447	1,873
9,326	8,442	9,239	8,172
2,059	1,854	2,019	1,881
3,171	2,263	2,986	2,032
7,150	6,560	8,375	7,454
32,289	32,779	34,869	36,169
7,650	8,395	8,825	8,475
8,111	8,690	8,403	8,649
61,607	58,126	66,675	60,222
	6,849		7,388
	5,296		5,280
	16,509		16,965
	5,187		4,962
	4,894		5,016
	1,792		2,274
	6,185		5,811
	2,718		3,162
	8,696		9,364
18,678	18,939	22,061	21,302
5,366	4,066	5,986	4,908
41,416	38,378	40,567	42,187
3,584	3,326	3,922	3,443
707	415	902	416
9,313	8,692	9,906	9,374

are given. *Includes data for spreader and calendering-type resins. ‡Includes data for acrylic, nylon, and other molding materials. *Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. †Includes data for acrylic rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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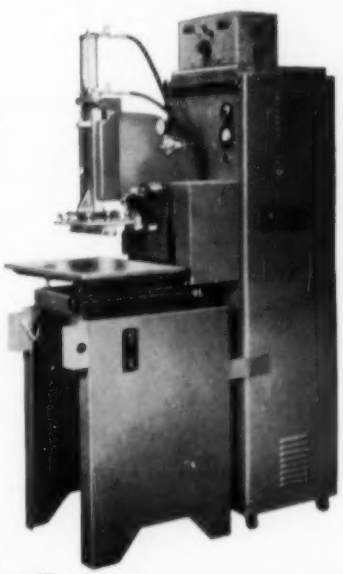

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Security of supply is a vital consideration in selecting a source, or sources, for wood flour. One reason is the combustible nature of wood flour during milling.

Wilner has two wood flour plants — completely separated — completely redesigned and rebuilt in 1951 — each plant safety engineered from the ground up.

In addition, the Wilner Company controls its own raw materials and its transportation, with elaborate rail facilities and its own fleet of trailer vans, to assure dependable deliveries under any conditions.

Typical Analysis
60 Mesh Wood Flour

Thru	On	%
	60	0
	80	2
140		76.8

Uses of Wood Flour

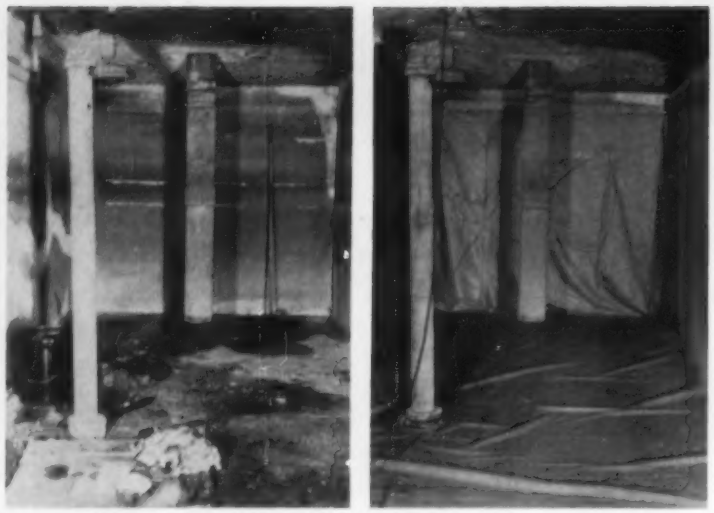
Wood flour is a *filler and extender*, adding strength, bulk, lightness and impact resistance to other more costly materials, such as plastics, linoleum, roofing felt, molded rubber products, wall board and vinyl floor coverings. It is an ideal *absorbent* for explosives, adhesives, rug and fur cleaners, stock feeds, and fertilizers (with built in insecticides?), and an effective *mild abrasive*, for cleaning metal surfaces, such as molds.

Other prospective uses include very fine filtration work; as a *binding agent* and *moisture absorbant* in ore processing; as an *anti-binding agent* to give desired porosity after burn-out in products like firebrick.

For samples, further information and specifications, please write:

DEPT. L-3C

Wilner Wood Products Co., Norway, Me.



Water seepage in diesel-engine water cooling tank (left) is eliminated by vinyl lining fabricated to fit around inside surface (right)

Vinyl lining prevents water seepage

By lining the inside of a concrete cooling tank with vinyl sheeting, problems of excessive water seepage through cracks in the concrete wall have virtually been eliminated.

The concrete tank, 21 ft. long, 6 ft. high, and 6 ft. wide, is used in a diesel-electric plant. In it, hot water from the diesels is mixed with cold water in the tank, then returned to cool the engines. Prior to the installation of the vinyl lining, the sharp differences in temperatures between the water in the tank and that from the engines caused severe cracking in the walls and floor. Water seeping from the tank widened the cracks and eventually caused uneven settling of the tank and plant foundations. The seepage loss grew so great that, when the engines were shut down from midnight to 6 A.M., the water level dropped to a point where the circulating pumps lost their prime.

A costly process of grinding the cracks into V-shaped troughs and filling them with water-resistant material helped some, but the water level still dropped several feet during the 6-hr. morning period.

With the introduction of the vinyl lining this problem was eliminated. The lining is made up of strips of 20-gage vinyl sheet, heat sealed together to form a "bag" to the approximate dimensions of the inside of the tank. The "bag" is suspended from 1- by 3-in. redwood strips bolted to the top of the concrete tank. The lining is not fastened to the wall at any other point; water pressure inside the tank keeps the lining in place yet allows it to move freely when the differential in water temperature inside the tank causes unequal expansion and contraction of the tank walls.

Where outlet pipes project into the tank the lining is bolted securely to flanges welded around the pipe; the part of the lining covering the pipe opening is cut out and removed.

The entire installation, including preparing the wall by removing sharp projections and hanging the vinyl lining, required only about 24 man-hours. The linings are easily installed and can be custom-fabricated to meet individual requirements to restore tanks made of dried out wood or rusted metal.

Credits: Lining fabricated by Bilnor Co., Brooklyn, N.Y.; installed by the Utah State Agricultural Experiment Station in the Logan City Diesel Plant, Logan, Utah; Krene vinyl supplied by Bakelite Co., a Div. of Union Carbide and Carbon Corp., New York, N.Y.

U.S.I. POLYETHYLENE PROCESSING TIPS

Vol. 1, No. 4

Molders Can Minimize Shrinkage

Shrinkage of injection molded items is often a troublesome problem for molders. In closures, and in components which are to become part of an assembly, excessive shrinkage can be a major cause of rejects. The growing use of polyethylene for such parts has sparked molder interest in shrinkage control on items made from polyethylene resins.

While a certain amount of shrinkage is inherent in any process that involves cooling of a material from elevated temperatures, it is possible for injection molders to minimize the condition to acceptable levels.

In polyethylene, such control may be achieved by the right choice of operating conditions and by selection of a resin with characteristics to fit them.

Lower Temperatures Key to Less Shrinkage

Since shrinkage is a natural result of cooling, a main avenue of attack on the problem is to mold at lower temperatures. Here are some procedures that tend to reduce shrinkage:

Reduce barrel temperature and run a cold mold.

Use high pressure and long inject time to pack the mold as much as possible, short of causing the item to stick.

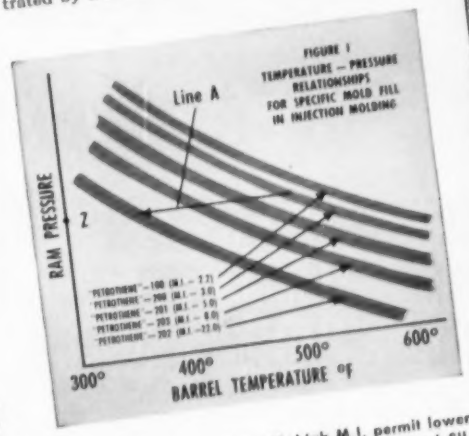
Allow longer dwell time. This helps to equalize temperatures throughout the mass so that cooling takes place at a uniform rate.

This point deserves further comment. Since the last material to flow into the mold is considerably hotter than the plastic at the extremity, a substantial temperature differential may still exist when the mold is opened. This uneven cooling results in non-uniform shrinkage which, in turn, causes the item to warp. Longer dwell time permits some equalization of this temperature difference and thereby keeps uniform the shrinkage that does occur. (The problem of warpage is discussed more fully in a previous issue of "Processing Tips". Write for a reprint if you missed it.)

High Melt Index Resins For Lower Molding Temperatures

Polyethylene resins with high melt indices can be a big factor in reducing shrinkage. In the first place, high melt index permits lower molding temperatures. This means less cooling, hence less shrinkage. At the same time, their higher flow characteristics permit tighter packing of the mold.

PETROTHENE 202 and 203 polyethylene resins are well suited to operating conditions for minimum shrinkage. The high melt indices of these resins permit reduction of injection temperatures by 70° to 130° for a given fill, cycle time and ram pressure. This is graphically illustrated by a set of curves for a particular mold:



Curves show how resins with high M.I. permit lower molding temperatures for a given pressure and fill. At pressure Z, a resin with comparatively low M.I., such as PETROTHENE 200, may require a barrel temperature of 500°F. Under the same conditions, PETROTHENE 203 requires 430°, PETROTHENE 202 only 370°.

Special Problem? Call on U.S.I.

In general, the suggestions outlined here will reduce shrinkage of molded polyethylene items. Some experimentation may be necessary, of course, to achieve a satisfactory result for your particular situation. In many cases, a switch to high-flow resins such as PETROTHENE 202 or 203, where these resins are satisfactory for the end-use, will permit operation at best conditions for minimum warp.

If the nature of your product creates an unusual problem, don't hesitate to call on U.S.I. for technical assistance. Well qualified Technical Service personnel stand ready to help you find a practical and economical solution.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
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- Special! . . . easily-removed panels permit quick, thorough cleaning.
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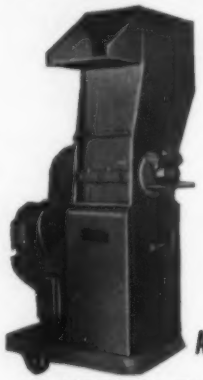
- It's on wheels! . . . rolls right up to your molding equipment.

. . easiest-to-clean unit on the market!



SPECIFICATIONS
8 by 10 inch throat
2 reversible bed knives
2 reversible rotor knives
1½, 2, or 3 h.p. motor
55° angle knives for polyethylene and warm materials

DIMENSIONS
Height ..... 52½ inches
Floor space ..... 20 by 30 inches
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BUFFALO 5, NEW YORK

Rigid phenolic foam

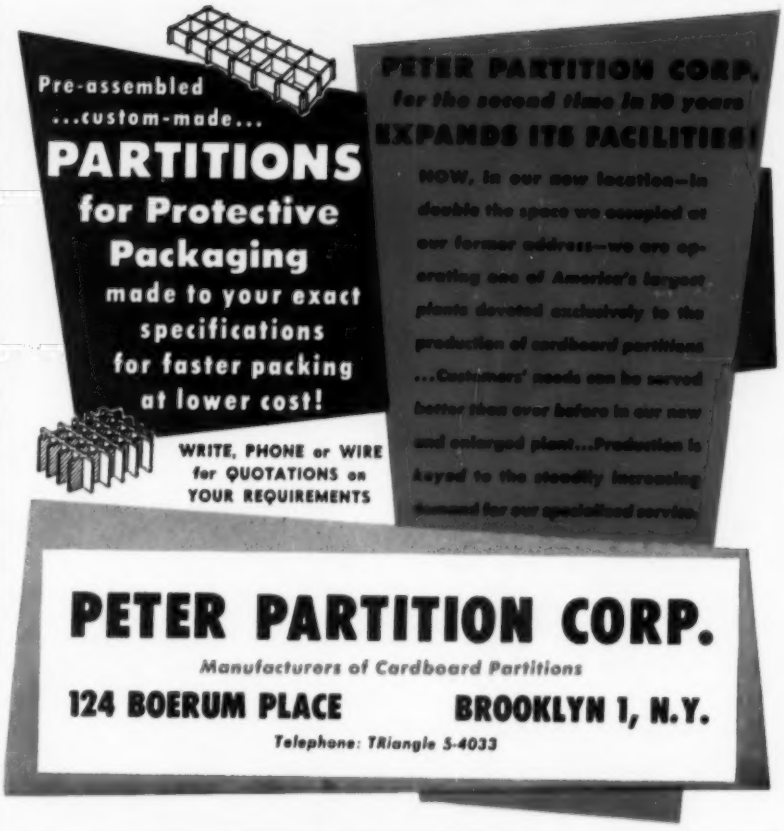
Rigid blocks of foamed phenolic resin are providing the handicraftsman with a new do-it-yourself material that can be easily cut and shaped into attractive vases, bowls, trays, desk sets, etc., with such simple hand tools as ordinary chisels, knives, files, saws, etc.

The use of foamed phenolic offers a variety of advantages for this type of application: it has practically no grain and can be finished to simulate the appearance of carved stone; it is resistant to ink, food, and most chemicals; it will not soften under the heat generated by cutting tools; and varnish, shellac, lacquer, enamel, or any other paint can be used as a coating without softening its surface.

The foam can be easily and accurately carved into almost any shape. In turning out a vase, for example, power tools (drill press or lathe) may be used to form the block of foam into a rough outline. The outside and inside surfaces of the partially completed vase are then shaped with a chisel. Sandpaper is used to obtain desired smoothness, and the dust is easily removed with air jet, vacuum cleaner, or slapping with a rag. Several coats of a clear, fast-drying finish brushed over the carved surfaces will seal the pores against moisture.

Credits: Synrock phenolic foam produced by the V. L. Smithers Mfg. Co., Akron, Ohio; phenolic resin supplied by Bakelite Co.

Block of rigid phenolic foam being made into vase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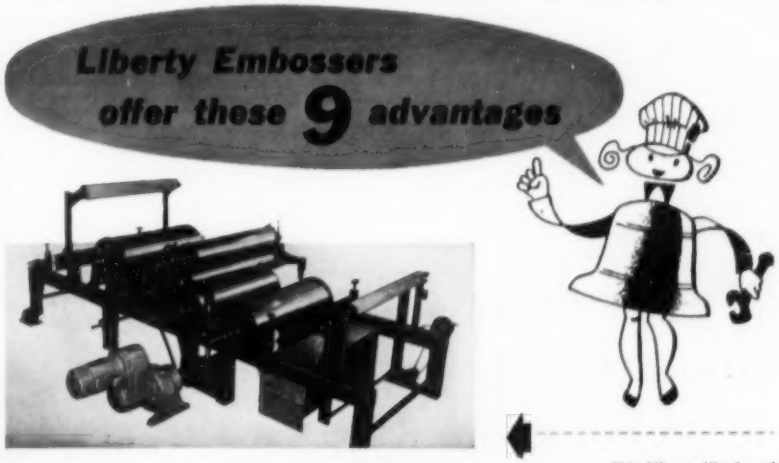
Liberty Embossers offer these 9 advantages
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Tiny polyethylene "pillows," used as tank covers, reduce liquid evaporation

Floating polyethylene retards evaporation

Polyethylene "pillows," which are actually tiny floating tank covers, are designed to retard up to 70% of the evaporation of liquids in open tanks and vessels, thus greatly increasing service life of the solutions.

The pillows, 1¼ in. long, ⅝ in. wide, and ¼ in. thick, are fabricated from extruded polyethylene tubing having a wall thickness of 0.015 inch. They are air-inflated for buoyancy, and sealed at both ends. A 1½-in. thick layer of pillows is claimed to be sufficient to retard evaporation regardless of the type of solution in which they are used.

In addition to their virtually unlimited life, chemical resistance to almost all reagents, and light weight, the polyethylene pillows offer the added advantage of allowing easy access to the solution they are protecting, without need for lifting or removal. In a dipping operation, for example, the pillows give way and move aside as a loaded basket is lowered into the solution. When the basket is removed, the pillows immediately float back to their original position to provide complete surface coverage.

The pillows are being offered for use in conjunction with such liquids as nickel and chrome plating solutions, solvents at room temperatures, various types of reagents, etc.

Credit: Polyethylene pillows produced by American Agile Corp., Maple Heights (Cleveland), Ohio.

"What's different about GREX?"

Ed: We've been hearing a lot lately about GREX. What's so different about it, anyway?

Dave: It's the new high density polyethylene resin. Enormous potential in molding and extruding. Remarkable material.

Ed: How so?

Dave: Well, GREX isn't like ordinary polyethylene. GREX has an orderly molecular arrangement . . . the polymer chains are nearly parallel, and packed close together. Tight packing means fewer spaces between. So it's called "high density" . . . or "linear" polyethylene. You've seen the straight line molecule in GREX advertising. That means "linear".

Ed: Hm, that tight packing should give it better stiffness. Probably better heat resistance, and less permeability, check?

Dave: Right.

Ed: Sounds good. Available now?

Dave: Sample quantities . . . soon. Think we should try it?

Ed: Yessir!

GREX*

POLYMER CHEMICALS DIVISION
W. R. GRACE & CO.

225 Allwood Rd.
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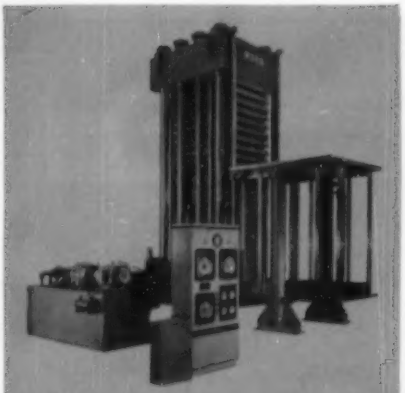
Plant:
Baton Rouge, La.

*Trademark for W. R. Grace & Co.'s polyolefins



2000-ton R. D. Wood Hydraulic Press for laminating and polishing plastics. Press has 10—4" openings, platen size 42"x83", and is of the completely self-contained type, including pumping unit for semi-automatic control of time, pressure and temperature. Press is equipped with hydraulic loading and unloading elevator. Send for complete details of this or other R. D. Wood presses for the plastics industry, without obligation

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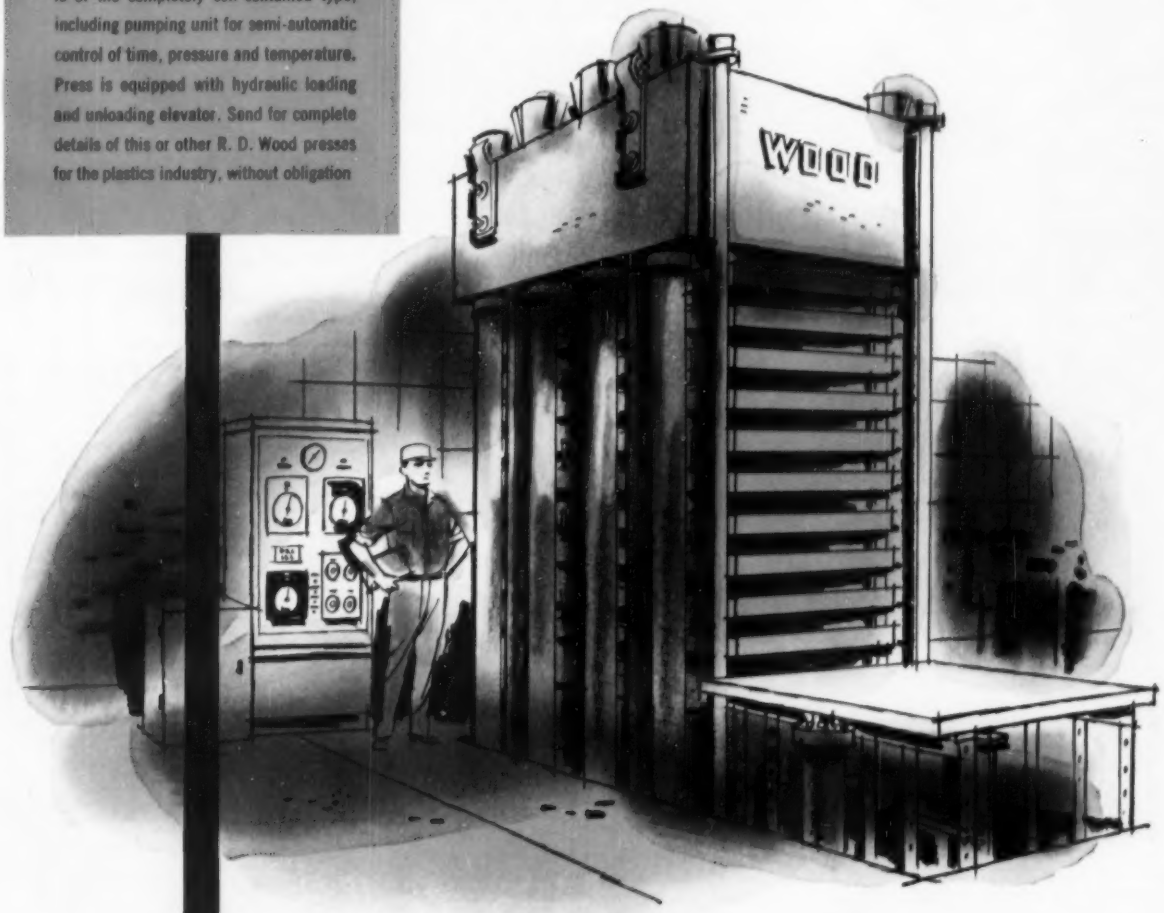

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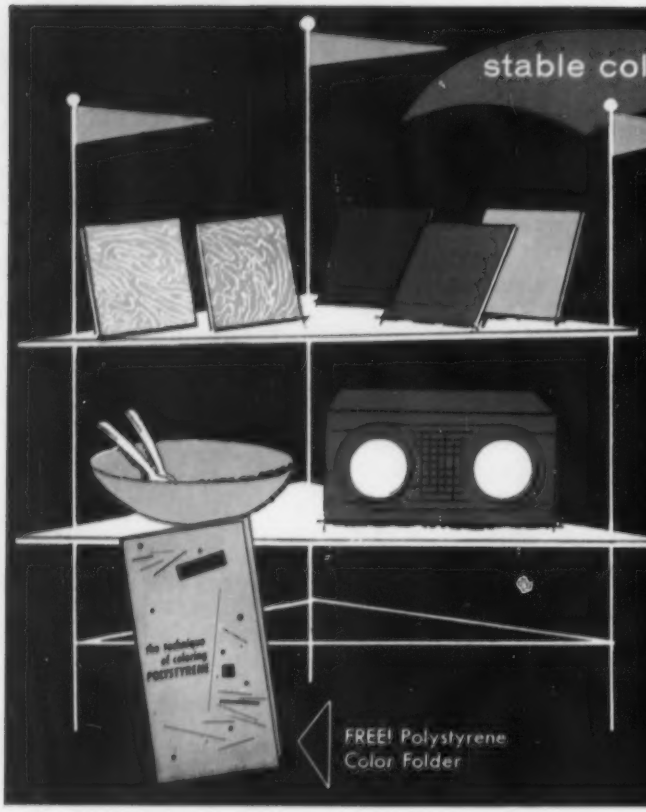

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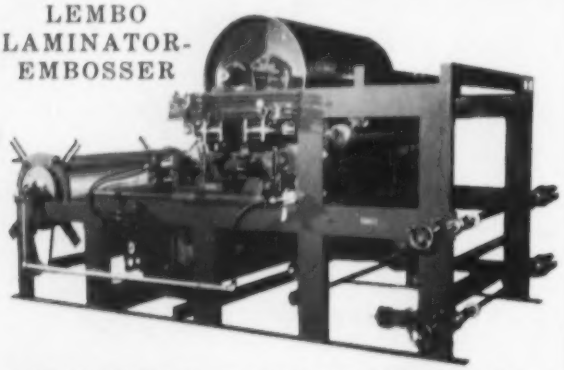

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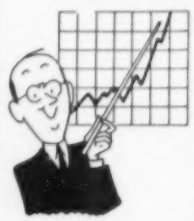

Quite frequently our technicians are called upon by fabricators to suggest means of perfecting and speeding up difficult plastic sealing operations. By intense application—by designing and building special equipment—we are most always able to raise quality as well as the rate of production.

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A standard Mayflower press has 18"x30" flat bed; powered by Mayflower 3½kw. generator. Accurate and highly productive in a widely diversified application of tear sealing.

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Glass-polyester washing machine parts

Molded reinforced plastics components that are durable, light in weight, and resistant to detergents and other corrosive materials encountered during washing, contribute greatly to the efficient performance of a new family-size automatic washer.

The three reinforced plastics components of the washer include a square-shaped tub into which the wringer can be folded, a splash guard, and a table-top cover which fits over the tub (when the wringer is folded into it) to provide a convenient work surface for the housewife. The largest of the three components is the 20-gal. washer tub. About 3 lb. of fibrous glass roving and 6 lb. of polyester resin are used in its composition. It is match-metal molded using a preform technique, and is claimed to be one of the deepest draws attempted in the reinforced plastics field. Internal ribbing and a cavity to accommodate the wringer are molded into the tub.

The unit cost of the reinforced plastics tub is comparable to that of a porcelain tub of the same general dimensions (25 by 20 by 19½ in.).

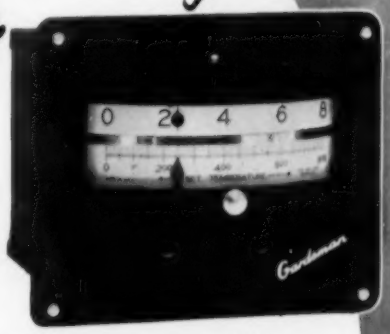
Credits: Foldaway washer manufactured by Apex Electrical Mfg. Co., Cleveland, Ohio; fibrous glass supplied by Owens-Corning Fiberglas Corp., New York, N.Y.

Washing machine has glass-reinforced plastics tub, splash guard, and cover

Find out why

more and more molders, extruders, and users of ovens, kilns, and furnaces are buying

Gardsman PYROMETRIC CONTROLLERS



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This modestly priced instrument automatically adjusts the ratio of power "on" and "off" over a time-cycle to maintain desired temperature. After heating to the "proportioning band" (1% of scale range) it "anticipates" temperature change of load, correcting for lag in both heating and cooling.

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Kensol Hot Stamping Presses are available in a full range of models from hand fed-hand operated to hopper fed-power operated. Compressed air operation, electric dwell-timer, thermostatic heat control, cast iron "C" frame, and double toggle construction are a few of the features which assure fine quality hot stamping, even on items that vary in thickness.

Send for Bulletin B-9

Olsenmark Roll Leaf is available in gold, silver and all popular colors, including luster colors.

Send for Color Chart B-11

Kensol 100

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Better catheters

A polyethylene catheter, packaged in a cellulose acetate butyrate tube provided with a polyvinyl chloride cap, is designed especially for use in repeated transfusions or continuous intravenous therapy.

In use, a needle larger than the polyethylene catheter is first placed in the vein. The catheter is then inserted into the vein through the needle, and the latter removed. A smaller needle, which closely fits the opening of the catheter, is placed in the free end and connected to a tube attached to a bottle of intravenous solution.

The flexibility, softness, and inertness of polyethylene make it an ideal material for the purpose. It has been found that blood and other clottable substances do not clot as rapidly in the polyethylene catheter as they do when in contact with glass or metal; the polyethylene catheters may be kept safely in the vein for several days to a week or longer.

Cellulose acetate butyrate was selected to package the catheter because of its transparency and ease with which it can be heat-sealed. It maintains the catheter in a relatively straight position, thus making it easier to handle and insert.

To maintain sterility and provide adequate protection, a "bunny tail" cap of flexible polyvinyl chloride is stretched over the end of the butyrate tube; the cap can be easily removed with a slight pull.

Another type of polyethylene catheter, used for collecting urine from the bladder, is packaged in a polyethylene pouch which doubles as a collection container. Urine is fed directly from the catheter to the pouch, thus eliminating need for glass bottles and other containers. The entire unit is packaged sterile and may be used without wearing rubber gloves. Both the pouch and the catheter are disposable.

Credits: Polyethylene catheters are manufactured by Dade Reagents, Inc., Miami, Fla.; all parts fabricated by Gering Products Inc., Kenilworth, N.J.

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NOW POSSIBLE WITH THE Logan HYDRAULIC PREFORMER

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Patents Applied For

Rag or flock filled, melamine "Fines" or general purpose materials can be preformed automatically. Large die area permits production of maximum size preforms. Multiple cavities can be used for smaller preforms. Processing with high bulk materials in your plant becomes automatic if you own a Logan Preformer.

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Automatic molding with Logan horizontal transfer machines and using preforms of high-bulk-factor type materials is the new way to reduce costs. Logan also has a complete line of semi-automatic molding custom engineered presses for compression and transfer use. Their exclusive features will appeal to you.

You will find it profitable to discuss your production problem with a Logan Engineer.

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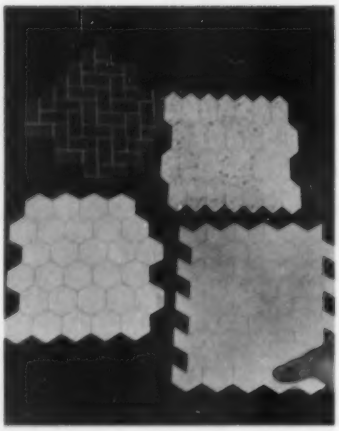

Samples of interlocking floor tile. Lower right sample is as-produced; grooves in others have been filled with seam compound

Interlocking vinyl floor tile

The eye-catching design of ceramic tile is combined with the warmth, resilience, and wear-resistant qualities of vinyl in a new floor covering. To achieve the effect of continuity, tile patterns (hexagons, chevrons, bricks, etc.) are pressed into individual slabs of vinyl that average 9 by 9 by ⅛ in. thick. The edges of the slabs are die-cut to conform to the pattern and interlock so that the joints between the slabs blend with the over-all design.

After the floor covering has been cemented into place, a special seam compound is rubbed into the grooves which outline the tile pattern, as well as into the joints between the interlocking slabs. Thus the effect of a solid, continuous, one-piece floor covering is achieved. Seam compound is furnished in a variety of colors.

In common with other vinyl floor coverings, the vinyl slabs are resistant to permanent staining from contact with common acids, alkalies, food, beverages, oil, and grease; are easily cleaned; and are simple to install.

Tiles are available in white and 23 decorator colors, in 72 styles, and are easily installed.

Credits: Ceramatile produced by Robbins Floor Products, Inc., Tuscambia, Ala.; vinyl resin supplied by Bakelite Co., New York, N. Y.

MM

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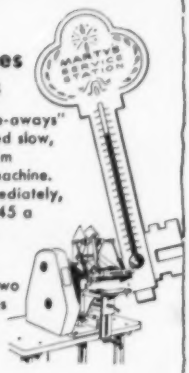
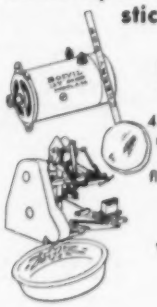
solved these marking problems

plastic novelties in three colors



Imprinting plastic "give-aways" on a hand press proved slow, poor in quality. Markem suggested their 45A machine. Quality improved immediately, production jumped to 45 a minute per color run. Result was better product, increased business, purchase of two more Markem machines to meet demand.

odd shapes . . . from lollipop sticks to solenoids



Object size, shape or irregularity often makes efficient marking a real problem. Markem's 45AG machine is proving remarkably versatile for marking plumbing fixtures, automotive parts and ignition coils . . . lollipop sticks, recessed lids and brushes. Well worth investigating for any difficult job.

fishing rod imprinting

Advantages of directly imprinting products are typified by a manufacturer who had been using decals on his fishing rods. A Markem 61A machine now imprints 600-700 rods per hour, of varying diameters and lengths. Markem Method saves him time and money, keeps pace with production.

Compare your method of product or package marking with the *Markem Method*. Write Markem Machine Co., Keene 20, N. H.

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EQUIPMENT • SUPPLIES • SERVICES

VACUUM FORMING EQUIPMENT. Illustrated 12-page brochure describes operating features of six vacuum forming machines in models with mold areas up to 74" by 50". Specifications included. Vacuum Forming Corp. **(G-601)**

SPRAY PAINTING EQUIPMENT. Bulletin describes a large automatic spray painting machine, designed to spray areas up to 12 inches wide and 40 inches long. Conforming Matrix Corp. **(G-602)**

ORGANIC SOLVENTS. 68-page manual describes in non-technical terms the properties and uses of a wide range of organic solvents, diluents, and thinners. Includes data on naptha and other hydrocarbon solvents, esters, ketones and glycol ethers. Central Solvents & Chemicals Co. **(G-603)**

INJECTION MOLDING MATERIALS. 50-page handbook describes methods of injection molding "Tenite" acetate and butyrate molding compounds. Gives data on mold and product design, material selection, and fabricating, finishing, decorating, and assembling operations. Eastman Chemical Products, Inc. **(G-604)**

PLASTIC SEALER. Bulletin describes 2½ kw. high frequency plastic sealing unit. Describes operating features and gives specifications. Unit handles either formed dies or sealing bars. Reeve Electronics, Inc. **(G-605)**

STEARATES. 36-page technical bulletin describes company's extensive line of stearate compounds having applications in the plastics field as gelling agents, mold lubricants, stabilizers, release agents. Properties, applications and analytical procedures are included. Witco Chemical Company. **(G-606)**

ACRYLIC FABRICATION. 80-page handbook gives detailed instructions on the design, construction, fabrication and maintenance of acrylic signs and displays. Rohm & Haas Company. **(G-607)**

NYLON MOLDING. 12-page brochure illustrates and describes company's specialized facilities and equipment for the custom extrusion and molding of nylon parts and components. Danielson Manufacturing Company. **(G-608)**

HIGH PRESSURE LAMINATES. Illustrated 20-page catalog describes the "Panelyte" line of laminated thermoset plastic materials available in sheet, rod and tube forms. Classifications, properties, suggested fabricating techniques are included. St. Regis Paper Company. **(G-609)**

STRUCTURAL LAMINATE. 28-page illustrated manual describes properties, characteristics, grades and thicknesses of "Plastirlv-Mel," a phenolic melamine impregnated laminate. Detailed machining, forming, fabricating and installation instructions are given. RIV. **(G-610)**

ANTI-STATICS AND MOLD RELEASES. 12-page booklet describes line of anti-static solutions and mold releases for a wide range of plastics. Describes application methods and recommended uses. Chemical Development Corporation. **(G-611)**

POLYETHYLENE EXTRUSION LAMINATOR. Eight-page illustrated brochure describes a line of three "Dilts" extrusion laminators, designed to combine polyethylene film with paper, tissue, board, foil, fabric and cellophane. The Black-Clawson Co. **(G-612)**

HANDBOOK OF SPECIAL-PURPOSE ADDITIVES. 36-page illustrated handbook describes five grades of "Chlorowax" chlorinated paraffin additives for plastics compounds, formulated to improve chemical resistance, flame retardance, and water repellence. Diamond Alkali Co. **(G-613)**

STABILIZERS. Bulletin contains suggested vinyl stabilizer combinations for plastics coating, molding, forming, and dip coating applications. The Harshaw Chemical Co. **(G-614)**

WEIGH FEEDER FOR INJECTION PRESSES. Illustrated brochure describes company's weigh feeder that is mounted above injection press and feeds precise, predetermined quantities of plastics materials to the press. The Exact Weight Scale Company. **(G-615)**

FASTENING ANALYSIS SERVICE. Folder describes service that provides "no-obligation" analysis of any products using fasteners. Analysis includes general product diagnosis, detailed recommendations, and sketches of each suggested application. Tinnerman Products, Inc. **(G-616)**

CUSTOM MOLDER OF REINFORCED PLASTICS. 12-page illustrated brochure describes facilities of custom molder specializing in fibrous glass reinforced parts and sandwich constructions. Winner Mfg. Co., Inc. **(G-617)**

PLASTICS WELDING. House organ contains technical data on hot gas welding and on "Agiline-HT," a processed polyethylene with high tensile strength and heat resistance. American Agile Corp. **(G-618)**

INJECTION MOLDING PRESS. Illustrated folder describes 4-ounce injection molding machine that features injection pressures up to 20,000 psi. Fully automatic unit will accommodate molds as large as 13⅜ by 22 inches. The Lewis Welding and Engineering Corporation. **(G-619)**

FAR-INFRARED HEATERS. Illustrated brochure describes in detail the features and advantages of "Chromalox" electric radiant heaters, shows many actual installations, lists specifications and prices. Edwin L. Wiegand Company. **(G-620)**

EXTRUDERS. Illustrated catalog describes and gives specifications of line of extruders with diameters from 1½ inch through 12 inches. Also covers auxiliary equipment including film dies, take-up units, pelletizers, cooling and polishing roll assemblies. Hartig Engine & Machine Co. **(G-621)**

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EQUIPMENT • SUPPLIES • SERVICES

TOOLING RESINS. Data booklet gives technical information about "Tylene" line of epoxy resins for such tooling applications as die surfacing, laminating and casting. Includes properties, tables, discusses procedures for making plastic tools. Tylene Plastics, Inc. (G-622)

POLYESTER PREIMPREGNATED GLASS CLOTH. File folder contains samples, technical data sheets and price lists for "Stanpreg," a high-strength, flame-resistant polyester-impregnated glass cloth. Standard Insulation Co. (G-623)

COATING EQUIPMENT. Illustrated 6-page folder describes line of roller coaters, coating one or both surfaces and either or both edges of flat sheet stocks up to 108 inches wide and 4 inches thick. Gives specifications, diagrams, operating features, and applications. Union Tool Corp. (G-624)

INJECTION PRESS. 6-page illustrated folder describes company's preplasticizing type 90-ounce injection machine. Gives specifications and operating features, describes component parts. Lists available accessory equipment. Watson-Stillman. (G-625)

FUSING AND DRYING MACHINES. Illustrated catalog describes company's line of curing, fusing and drying equipment for processing coated web stocks. Machines are suitable for fusing vinyl coatings, setting phenolics, drying coatings and lacquers, removing solvents. Includes specifications. F. C. Dawson Engineering Co. (G-626)

ROLL LEAF. Folder contains sample swatches of gold and aluminum Mylar-backed leaf for hot die stamping. Includes prices. Ralph W. Grauert, Inc. (G-627)

INJECTION MOLDERS. Illustrated 30-page catalog offers detailed description of company's ¾ ounce injection molding machines designed for small runs where high production is not required. Gives specifications for each machine, discusses basic structure of the line. Newbury Industries. (G-628)

SHEET FORMING MACHINES. 8-page illustrated brochure describes three vacuum forming machines: a single table model, a twin-table model, and a unit that forms contour packaging from roll fed sheet stock. Covers operating features of machines and includes dimensions, specifications. Comet Industries. (G-629)

INFRARED OVENS. Illustrated 20-page brochure describes extensive line of radiant-heat ovens designd for baking, drying, and preheating. Discusses operating principles and maintenance. Fostoria Pressed Steel Corp. (G-630)

TEFLON APPLICATIONS. 16-page illustrated catalog describes line of Teflon sheet, rod, tape, and tube stock. Includes a chart on properties of Teflon and discusses application of the various products. Continental-Diamond Fibre Co. (G-631)

PRINTED CIRCUITS. 12-page illustrated brochure describes use of line of copper-clad phenolic-base laminated "Phenolite" sheets for printed circuits. Lists available grades and types. Discusses nature and advantages of printed circuits in general; describes various methods of printing. National Vulcanized Fibre Co. (G-632)

DIE MILLING MACHINE. 16-page illustrated brochure describes company's "Contourmaster" tool and die milling machines suitable for production of small and medium size plastic molds, embossing dies, master hobs. Lists specifications, and covers features. Cincinnati Milling Machine Co. (G-633)

WEB TENSION CONTROL. Illustrated folder describes unit for automatic control of web and filament tension during processing operations involving winding or unwinding. Web Controls Corp. (G-634)

NYLON MOLDING ACCESSORIES. 8-page illustrated brochure describes special accessories for molding nylon. Covers nozzles, annealing tanks for molded pieces and drying ovens. Gives specifications and prices. Injection Molders Supply Co. (G-635)

COLOR PROPORTIONER. Bulletin describes equipment that proportions and blends colorants and molding compounds automatically in one continuous operation. Output rate—up to 1000 lbs per hour—synchronized with injection press or extruder speed. Progressive Machine Co., Inc. (G-636)

POLYAMIDE RESIN. Technical bulletin describes "Versamid 125," a polyamide resin used to form thermosetting adhesives and sealants. Lists physical and chemical properties, discusses formulations. General Mills. (G-637)

EXTRUDERS. Technical bulletin describes construction features and operation of line of direct electrically heated extruders having length-to-diametr ratio of 20:1. Includes data on accessories. Lists specifications. Prodex Corp. (G-638)

"A-C POLYETHYLENE." 14-page technical bulletin describes company's grades of low molecular weight polyethylene. Gives typical properties and discusses end uses. Includes a compatibility listing. Allied Chemical & Dye Corp. (G-639)

PYROMETRIC PROPORTIONING CONTROLLERS. Illustrated folder gives details of a proportioning temperature control which automatically adjusts the ratio of power "on" and "off" over a given time cycle to maintain any desired temperature. Discusses applications in injection molding, extruding and other plastics processing operations. West Instrument Corp. (G-640)

ELECTRONIC HEATERS. Illustrated folder describes extensive line of induction and dielectric heaters. Gives specifications. Scientific Electric. (G-641)

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Marked improvement in low temperature flexibility is shown in films made with Conoco H-300.

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Mixtures containing Conoco H-300 have appreciably lower initial and aged viscosities.

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Can save the processor as much as 2 cents per pound on the finished product. Conoco H-300 can be used to the extent of 25% of the total plasticizer required.

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Formulations are more readily mixed because of fast wetting and internal lubricating properties.

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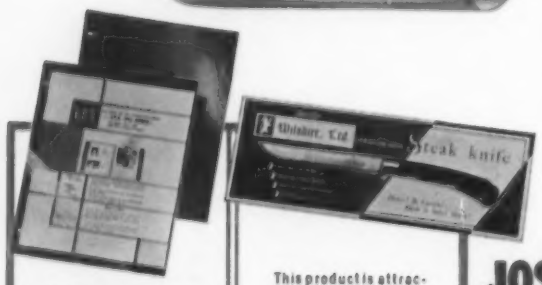

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Unrealistic quotes

(*From pp.* 81-84)

ignoring such impossible competition. In the present and immediate future period of expansion in productivity, the impossible competition cannot possibly get or do more than a small percentage of the work—and sooner or later the auditor's cost factors will catch up with them and their prices will have to equate those of molders doing business on a sound basis.

From the mold maker

The cost of a mold, while dependent upon the intricacy of the article to be produced and the number of cavities, is more dependent today on the hours of labor consumed and the type of material used in the construction.

By far the majority of molds must be made in less time than that in which it is economically sound to produce them. Time after time a job is quoted at 14 to 16 weeks delivery, only to have the molder, prodded by his customer, insist that he can place the order only if he can get the mold in ten to twelve weeks. Mold makers legally work 40 hours a week and must be paid on the basis of time and a half and, in some instances, double time for overtime. This means that the mold maker's customer pays up to 25% more for labor on some jobs and, what's worse, pays for lowered labor efficiency in the overtime period.

A frequent complaint against plastics molders and their end-user customers is the lack of preparation on the part of the former and the lack of proper planning on the part of the latter, who has to use the component. Not enough model making is done before mold design is begun. Not enough study is usually given at blueprint stage to changes which might lower piece costs and help in establishing proper mold prices.

The material—the metal—used in making the mold generally represents about 10% of the total cost. On that basis a saving of 10% by using inferior materials is foolhardy. Both molder and his customer should approach a mold not on the basis of what it costs, but what is the best mold for him —what mold will produce his

a *BIG* market for plastics . . . the packaging field

"Big Market," is right! The men who select the materials used to package the output of American industries control a market that will exceed the 10 billion dollar mark this year.

This rich market is composed of about forty industries. It includes manufacturers and packagers of such products as foods, cosmetics, chemicals, drugs, candies and tobacco products. In all these highly competitive industries frequent packaging changes are the order of the day. Factors ranging from fascinating sales appeal to plain hard costs influence the men who make the packaging decisions. Consequently, no one type of packaging material (glass, metal, paper or fabric) ever has assurance that it won't be supplanted by another.

And now plastics have entered the arena as directly competitive materials for packaging. In just the last few years they have come to play an increasingly important role—and often at the expense of older "traditional" materials.

Especially noteworthy is the fact that plastics can be used in the manufacture of almost every basic package type: box, bag, bottle, drum, jar, vial or collapsible tube!

Right now this frontal invasion of the packaging field by alert plastics manufacturers, molders, laminators and fabricators has just begun. And their chief sales tools are the two publications which reach the men who make packaging decisions—MODERN PACKAGING Magazine, issued monthly, and the annual MODERN PACKAGING ENCYCLOPEDIA ISSUE.

Get full details about this Rich Market

Additional data on using these media to help expand your sales to the packaging market are contained in the booklet "The Packaging Field and How to Reach It." Write for your copy.

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product faster, better, and with a minimum of rejects.

The type of mold to be used is important. And customers coming to mold makers frequently lack information as to what they need. There is a great difference between an automatic mold and a hand-core mold in cost, a great difference between costs of hardening steels, a great difference in costs of cooling methods, a great difference between vapor-hone finish and optical finish—and designs on all these points must be made from the standpoint of quality of product and time of mold making before the mold maker can establish any price.

Aside from the above factors, with modern plastics materials it is possible to design to tolerances of plus or minus 0.004 or 0.005 in., which will cause a mold to be lower in cost than one made for a product designed to an *impossible tolerance* of 0.001 inch.

The *taper* or *draft* on molds is of great importance: the less draft, the more trouble in piece ejection, and the higher cost to the mold maker (as well as to the molder and his customer) in getting an operative mold.

If a mold is to run *automatically*, it will have to be the very best mold that can be produced because, if for any reason, in one shot out of ten, the molded piece is not ejected from the cavity or off the core, the mold in the machine will not run automatically. It is the mold and not the machine that runs automatically, and more and more molds are being made—at naturally higher costs—for full automation.

Molder's customers are seeking consistent quotations on parts; molders are seeking means to provide low-cost parts at a reasonable profit. In a recently held meeting of some of the finest mold makers, it was discovered that not a single mold maker made over 5% profit before taxes.

Aside from expected costs in mold design there are a great many unforeseen costs, such as making a mold to run at a faster cycle than was originally planned, the addition to the design of knockout pins or draft, the changing of gates and expansion of gates, which must be included in mold prices and which could be eliminated if complete understanding of responsibility between molder's customer, molder, and mold maker can be established.

Conclusions

As the plastics custom molding industry becomes larger in business unit size, as more mergers are consummated, as long run molding jobs increase in number, as automatic production becomes the rule rather than the exception, the personnel and talent pattern in molding companies will change. The engineer, and the estimator, working with the auditor will approach the task of consistent quotation on a much more scientific basis than at present and, since tools for fabulous quantity production at low cost must be superior to any tools for plastics molding in the past, there will be more concentration on design and engineering and on proper allocation of costs.—END

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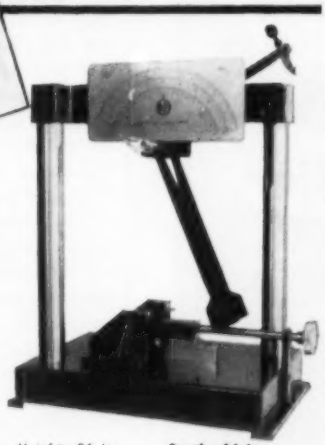

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Italy

(*From pp.* 90-94)

produced in Italy. Some are emulsion type; others are suspension type, suitable for the manufacture of extruded and calendered film and sheet, for spreading, and for slush molding. One type recently put on the market is suitable for manufacturing rigid articles by injection molding.

Italy is self-sufficient as regards the most important primary plasticizers and some stabilizers.

All well known articles are manufactured in Italy—from rigid pipes to flooring, from cable insulation to slush molded objects.

Italy, like Germany, has had extensive experience with rigid P.V.C. The extrusion of rigid vinyl in Italy is an exact science, studied by all the world.

Vinyl acetate resins are also produced in Italy and have important markets especially as latices, adhesives for wood, and water-mix paints for interiors.

Some types of polyvinyl alcohol are made and recently the production of polyvinyl acetals was started.

Polyethylenes: Italy was the first country in continental Europe to produce polyethylene by the high-pressure method. The low-pressure method of production has recently been started, by which very high-molecular-weight grades can be had. About half the production is used for the manufacture of blown films, but the manufacture of bottles, containers, and drums made by extrusion and air-pressure within molds is rapidly increasing.

Injection molded articles are produced in large numbers, while pipes and electric cable insulation have a more limited production.

Nylon: Polyamide molding powders are produced in Italy by the Rhodiatoce, a company in the Montecatini Group, and are used for the manufacture of toilet articles and an assortment of objects such as gears, fastenings, etc.

Cellulosics: These resins have felt strongly, in Italy as in all countries, the competition of lower cost thermoplastics resins. They are used for the manufacture of combs, spectacle frames, tooth brushes, motorcar fittings,

etc. Italian production is amply sufficient for the home market.

Specialty resins: Polytetrafluoroethylene is produced in Italy and is used chiefly for equipment for the chemical industry. Ion exchange resins are being adapted to several industrial processes. Epoxy resins and epoxy alloys of a particular kind, suitable for special applications, are also made. The so-called "isotactic" polymers, first produced by Montecatini, will soon be on the market.

Engineering and equipment

Italian engineering for plastics embraces literally every technique known in other lands, and Italian ingenuity has refined and improved some of them.

Examples are: the production of "spotted" buttons which are exported all over the world; vinyl-coated fabric, to which is conferred, by a special process, the quality of "breathing"; the production by a continuous process of corrugated fibrous glass-reinforced polyester laminates; polyester-paper laminates, made also with a continuous process.

Machinery for plastics processing made in Italy is excellent in engineering quality and is exported all over the world. Injection machines up to 70 oz. are manufactured, and some makes are suitable for molding all types of thermoplastic materials, including a special rigid polyvinyl chloride produced in Italy, from which can be made pipe fittings, valves, etc. Among the extrusion machines there is a special patented model, with which pipes and different shapes having an irregular surface can be covered with a layer of uniform thickness. High vacuum metallization is often applied, especially on polystyrene and methyl methacrylate, with Italian machines. Welding of vinyl is frequently used, and vacuum forming is developing rapidly. Machinery for making reinforced plastics products exists.

This survey is but a short summary, but shows conclusively that the plastic industry in Italy is going through a period of considerable expansion and is certain to produce even more important developments in the future.—END

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Molded plastisol

(*From page* 105)

overcome all the shortcomings of the former metal model: it would not rust or scratch; it would present a neat appearance at all times; it would make possible improved locations for component parts; and it would allow more space for the sales message. The unit that was finally developed was molded in one piece, including the handle.

Molding the part

The tester housing is rotationally molded on casting machines. Pre-assembled, three-piece aluminum molds are filled with the plastisol, inserted into a locking device that holds several molds, placed in an oven, gang-rotated in more than one plane, cooled, and stripped. Total cycle time, from filling to stripping, is about 12 minutes.

A special mechanical device is used to open the molds at the end of the cycle. This device was developed to assure that all three parts of the mold are opened at the same time to prevent damage to the finished product. After the molds have been opened, a tear-out plug is removed from the case, producing the hole into which the syringe bulb is inserted.

When the meter is mounted in the housing, self-tapping screws are driven into molded-in Speednuts to hold the meter securely in place against the housing.

Parts are molded by a one-man production set-up; i.e., one man handles all operations from filling the mold to stripping off the finished parts.

Finishing

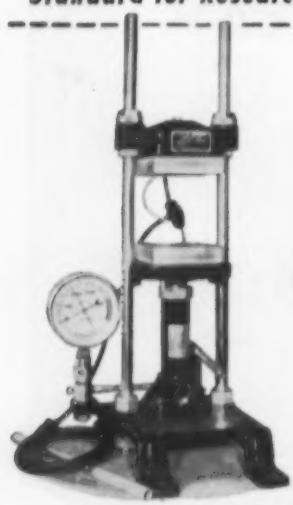
Trimming and decorating is done by the molder on an assembly line set-up. After the part has been trimmed, the lower portion of the one-piece housing, defined by a molded-in ledge, is spray-painted in blue. Lettering and decorative designs are then silk-screened on the housing in three colors. Since the part has compound curvatures and a ledge-type construction, the design of silk screens that would lie flat on the case and register color perfectly was a major problem that had to be solved by the development of special jigs.

Another problem that was successfully solved was the formulation of silk-screen paints that would be compatible with the plastisol formulation, with the blue spray-paint, and impervious to weather, water, gasoline, grease, oil, battery acids, etc.

After the housing has been decorated, the tester is forwarded to the Hickock Electrical Co., Cleveland, Ohio, for final assembly. This consists of installing the meter, leads, and prods, produced by Hickock. The finished piece, superior in every way to its predecessor, is then ready for distribution to Mobilgas stations.

Credits: Battery tester designed by Peter Schladermundt Associates, New York, N. Y.; molding by The Sun Rubber Co., Barberton, Ohio, on equipment designed by the company, using a plastisol formulation developed by Sun.

Standard for Research and Development



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Engineering materials

(*From pp. 127-139*)

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No name is better known on bicycle saddles than Mesinger because the H. & F. Mesinger Company has a way of being first with new saddle improvements, like their new models with one-piece molded vinyl tops by Stanley Chemical. Thanks to this waterproof, temperature-proof, and virtually wear proof material, conventional fabric-covered and leather saddles are losing their appeal. Leading cycle manufacturers were quick to take notice, and today more and more cycling Americans saddle up on a Mesinger for the softest, smoothest ride ever. This is only one of many custom vinyls by Stanley that are making products everywhere look better and sell better. How about yours? Write for literature to 71 Berlin St., East Berlin, Conn.

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Asbestos

(*From pp.* 140-148)

tos paper and bonding the assembly with resin, a "cushioned" product is obtained. The asbestos fibers tend to spread, surround, and cushion the glass warp. This style material, designated as Style 7550, is safely handled because good sidewise support exists for the warp. Novabestos Cushioned Glass Warp is suitable for fabricating structural members such as beams, tubes, rods, stressed skins, and rocket launcher bodies. The material is particularly adapted for winding as a tape and could be readily used for mass production items. It can be cross-laminated at various angles in order to distribute high physical properties over the entire structure.

Phenolic impregnated asbestos felt materials have been used in making at least three different types of aircraft wings and tested with good results. This type of material is also used for large scale production of external fuel tanks. Good service records are also reported for ducts, fairings, radar reflectors, and pressure vessels that are fabricated of this material.

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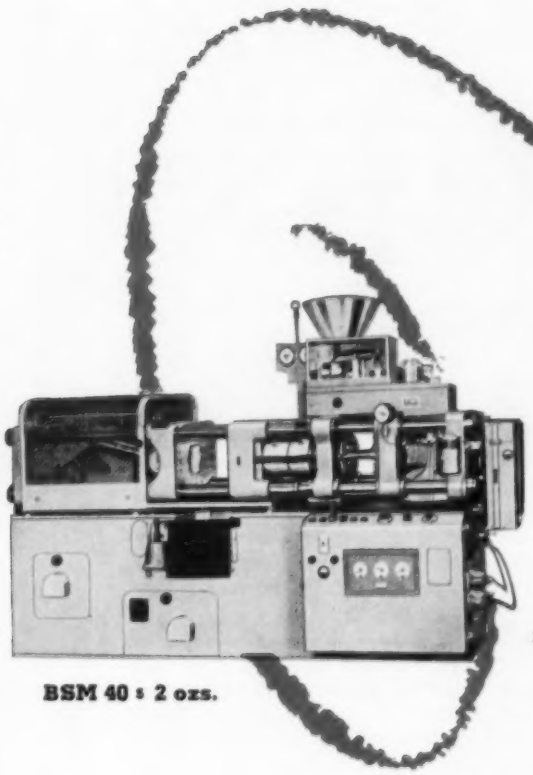

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 35*)

Teflon for bearings

Possible elimination of conventional lubrication in many types of bearings is foreshadowed by the recent development of woven Teflon fiber faces for metal automobile suspension joints.

In a technique perfected by American Metal Products Co., Detroit, Mich., in cooperation with Du Pont, producer of the material, Teflon tetrafluoroethylene fiber for a ball-and-socket suspension joint facing is first double-woven with a backing of nylon or cotton. The fabric is then laminated with cotton-reinforced phenolic resin and formed into a cup which lines the socket. Metal parts are coated with a special grease to prevent corrosion. The joint is assembled and the preformed bearing is molded in place. The joint is then sealed. Preliminary studies indicate that these bearings will last the lifetime of the automobile without lubrication or other maintenance and that they will not cause an increase in original cost over a standard joint.

Isocyanate foams

Two new self-curing polyisocyanate foams for insulating and reinforcing voids between structural members are now available from Adhesives and Coatings Div., Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit, Mich.

Designated Scotchfoam Brand Expansible Compound Type A and Type 1, they are two-part liquid formulations which, when mixed with a catalyst under proper conditions, can be foamed-in-place to produce a rigid cellular material ranging in density from 2 to 20 lb./cu. ft. that is claimed not to break loose, settle, or sag. Application to desired areas may be made by pouring or spraying.

According to the company, application of these foams for void filling and insulating has the following design advantages: low weight factor; adhesion to many types of surfaces without the need for supplementary adhesives or mechanical fasteners; curing without heating; freedom from fire hazard during application; and applicability to irregular surfaces without necessity of cutting and fitting operations.

Liquid stabilizer

A one-package liquid stabilizer for polyvinyl chloride resins and its copolymers has been developed by Harwick Standard Chemical Co., 60 S. Seiberling St., Akron, Ohio. The new stabilizer, compounded of zinc and barium organic salts with a chelating agent, is suggested for use either alone or with the combination of Harwick's other liquid stabilizers, Stabelan #110 and Stabelan #115, or some of the epoxy-type plasticizers.

The current price schedule for Stabelan #120 is as follows: 50-gal. drums, 65¢ a lb.; 30-gal. drums, 70¢ a lb.; and in less than drum lots, 75¢ a pound.

Thin Teflon tape

Cementable Teflon tape in thicknesses down to 0.005 in. is now available from Garlock Packing Co., Palmyra, N. Y. Such tape, according to the company, has heretofore been available only in thicknesses of 1/16 (0.0675) in. and up. The thinner tape is expected to expand use of Teflon as linings for containers and surfaces handling foodstuffs and corrosive materials. It is furnished with a slippery surface on one side and a specially prepared surface on the other side for bonding to plastics, metal, wood, glass, and other substrate materials.

The product is being offered in rolls in thicknesses from 0.005 to 0.060 in., in widths from ½ to 12 inches.

Plio-Tuf molding material

Developed for injection molding and extrusion with conventional equipment, an improved modified styrene resin in pellet form, called Plio-Tuf P100, has been announced by Goodyear Tire & Rubber Co.'s Chemical Div., Akron, Ohio. The uniform size of P100 is claimed to permit accurate metered feeding and promote an even distribution of heat through the material. According to Goodyear, items made of this material have good stiffness and high-impact strength, even at low temperatures; they also are essentially inert to chemical attack and have good resistance to high heat.

Products injection molded of P100 include radio cabinets, wash basins, chair arms, and valve units for process pumps. Products extruded from the pellets include insulation, welting, and pipe. Sheets may be extruded with conventional equipment and can be postformed to produce luggage, machine housings, television masks, advertising displays, automobile door panels, refrigerator door liners, hoods, vents, ducts, and others.

Plio-Tuf sheet

An interesting development in the use of Plio-Tuf sheet has been announced by Goodyear Tire & Rubber Co., Inc, Akron, Ohio. Use of this particular sheet has been growing considerably over the past year, but there has been very little publicity concerning its progress. Its newest announced use is for lining the interior of the control car of Goodyear's airship Ranger. Publicity describes the material as a modified styrene resin, but when Plio-Tuf was first announced it was reported in the trade to be a styrene and butadiene combina-

*Reg. U.S. Pat. Off.

Alert and progressive methods engineering on the part of Schwab Plastics Corp., plus a newly formulated flexibilized, low-temperature-curing epoxy adhesive developed by R & A, made possible the structural bonding of large blocks of rigid Styrofoam to resilient vinyl foam on a unique military assembly shown here in an early stage of production.

R&A

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Adhesives

for plastics and metals

Whether your bonding problems involve foamed plastics . . . or rigid solids . . . or flexible films . . . to themselves, to other plastics, or to metals . . .

Chances are, there's an existing formulation among the more than 650 standard BONDMASTER adhesives that will provide an efficient, cost-cutting solution for you.

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RUBBER & ASBESTOS CORP.
243 BELLEVILLE AVE., BLOOMFIELD, N. J.

The Plastiscope

tion *without* rubber, which is often used as a modifying agent in materials of this sort.

Former material used in the lining of the Ranger consisted of thin plastic sheet cemented to aluminum. The new construction replaces these materials at comparable weight and provides a more durable interior.

Bondmaster in tubes

Heretofore available in bulk containers, Bondmaster M620, a one-component epoxy-based adhesive produced by Rubber & Asbestos Corp., Bloomfield, N. J., is now also being packaged in 2-oz. tubes. The tubes, designated Unitainer, were developed by Sun Tube Corp., Hillside, N. J.

Bondmaster M620 is a thixotropic paste epoxy adhesive which is claimed to permit for the first time the mass production joining of rigid plastics, metals, and other rigid materials, eliminating the need for skilled personnel formerly required for accurate measuring, mixing, and weighing.

Because it is a one-component system, Bondmaster M620 can be packaged in a single tube. Earlier two-component adhesives required expensive double tubes or other containers to keep the components separate until ready for use.

Dial filler

Known as Anchor Dial Filler, a specialized coating formulated to furnish opaque color contrast on recessed or embossed dials, can be wiped off flat surfaces with a dry cloth during the initial drying period, leaving filled areas which form the pattern. Two types of filler are available—one which can be dry-wiped within minutes and a "quick-dry" formula that dries in seconds.

The filler can be applied to plastic, wood, metal, or ceramic objects of various shapes and sizes by brush, roller, squeegee, or spray. It is available in flat or dull gloss in shades to meet all color standards.

Anchor Dial Filler is produced by the Irvin, Jewell & Vinson Co., Dayton, Ohio.

C.M.R.A. elects

At the spring meeting of The Chemical Market Research Association, the following officers were elected for the coming year: President—Edwin M. Ott, Pennsylvania Salt Mfg. Co.; president-elect—R. E. Chaddock, Hercules Powder Co., Inc.; treasurer—J. William Everson, The Dow Chemical Co.; and secretary—Robert M. Henderson, American Cyanamid Co. C. P. Neidig, of White, Weld & Co., retiring president, was elected a director.

Molds for vacuum forming

A new firm, Quality Tools Corp., 108 Nassau Rd., Roosevelt, N. Y., has been set up to manufacture models and molds for use in vacuum forming plastic sheet materials. Sanford S. Zimmerman is president.

New fluorocarbons

Four new chlorofluorocarbons are now being offered in research quantities by the Sales Development Dept. of Hooker Electrochemical Co., Niagara Falls, N. Y. They are based on the company's C-46 and C-56 formulations and are expected to find use as chemical intermediates in the preparation of polyester resins, polyamide resins, elastomers, wetting agents, coolants, and many others.

TAPPI conference officers

The following chairmanships for the Eleventh National TAPPI Plastics-Paper Conference, to be held at the Institute of Paper Chemistry, Appleton, Wis., on October 3 and 4, have been announced by the chairman of the Plastics Committee, Joseph Pullman, American Cyanamid Co.: General chairman of the conference—T. A. Howells, Institute of Paper Chemistry; publicity chairman—Walter L. Hardy, Foster D. Snell, Inc.; and technical program chairman—R. W. Reiter, National Starch Products, Inc.

The two-day program will consist of papers discussing new synthetic polymers and testing procedures for paper coating, saturation, and beater addition.

Hot stamp leaf

Two new roll leaf products—a 24-carat gold and a No. 730 bright aluminum—have been announced by Ralph W. Grauert, 100 Gold St., New York, N. Y. Both are made with a carrier using Du Pont's Mylar film. The use of Mylar is said to give the roll leaf greater strength, thereby reducing lost time from breakdowns, and to enable the user to get sharper impressions.

Spray-coating

A complete series of sprayable vinyl dispersions is now available from Watson-Standard Co., 218 Galveston Ave., Pittsburgh, Pa. They are offered in both plastisol formulations (100% solids) and organosol formulations (80 to 100% solids) and are said to be easily applied by normal spray techniques.

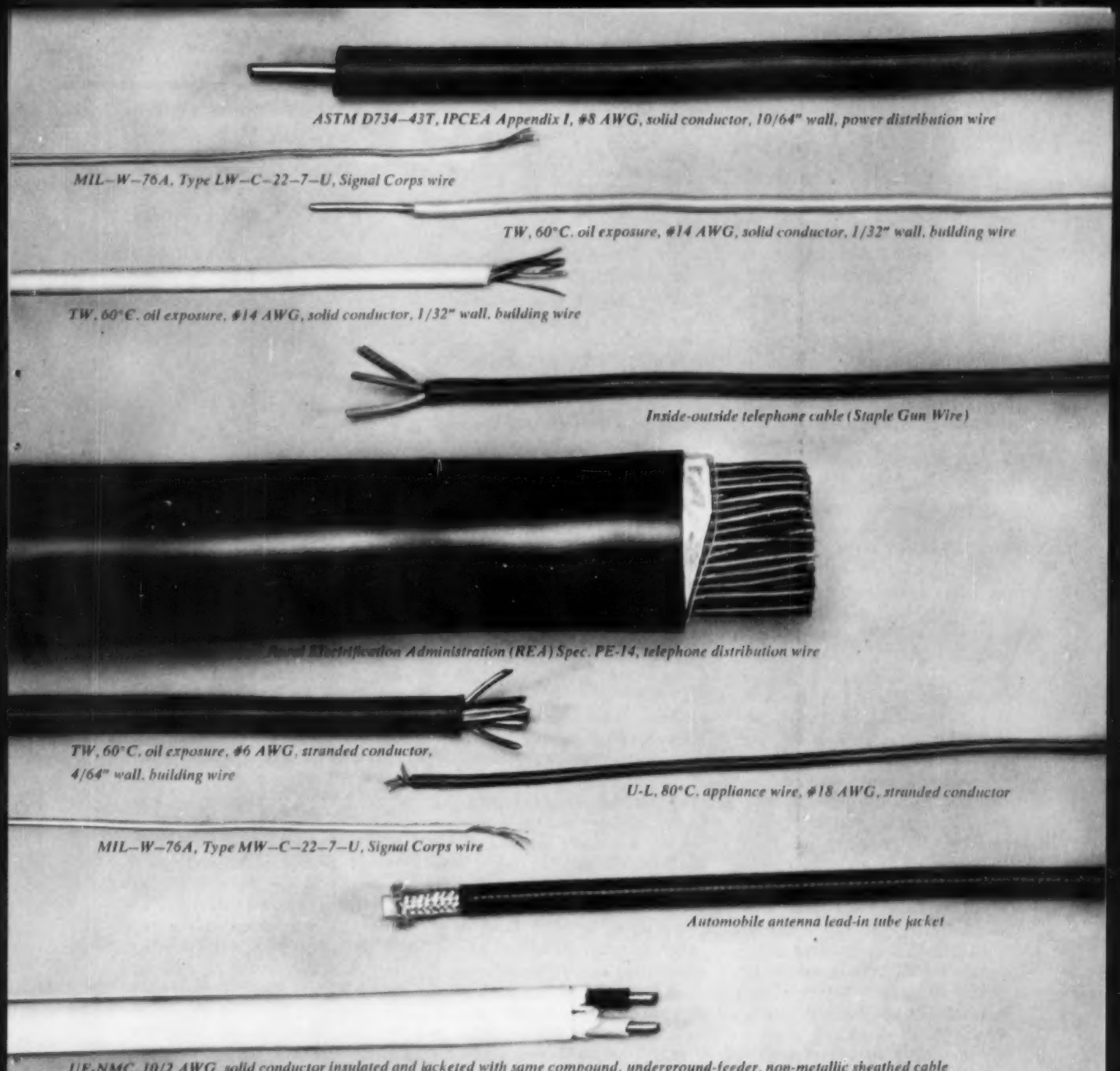
The compounds are supplied as liquids which are heat-cured at 350 to 400° F. to a resilient, chemical-resistant film or coating. Where bonding is desired, a suitable adhesive, formulated specifically for the particular application, can be provided by Watson-Standard.

A mixer for polyester

Commercial production of pure-grade flake trimethylolpropane has been announced by the Chemical Div. of Celanese Corp. of America, 180 Madison Ave., New York, N. Y.

The company states that a new lower price, 43¢ per lb. in carload quantities, makes possible economic use of this high-quality aldol product in a number of basic processing areas. Trimethylolpropane is an important component in production of polyurethane and alkyd resins. In addition, it can be used in synthetic drying oils, plasticizers, surface-active agents, and polyesters.

In alkyd-base baking enamels,


ASTM D734–43T, IPCEA Appendix I, #8 AWG, solid conductor, 10/64" wall, power distribution wire
MIL–W–76A, Type LW–C–22–7–U, Signal Corps wire
TW, 60°C. oil exposure, #14 AWG, solid conductor, 1/32" wall, building wire
TW, 60°C. oil exposure, #14 AWG, solid conductor, 1/32" wall, building wire
Inside-outside telephone cable (Staple Gun Wire)
Rural Electrification Administration (REA) Spec. PE-14, telephone distribution wire
TW, 60°C. oil exposure, #6 AWG, stranded conductor, 4/64" wall, building wire
U-L, 80°C. appliance wire, #18 AWG, stranded conductor
MIL–W–76A, Type MW–C–22–7–U, Signal Corps wire
Automobile antenna lead-in tube jacket
UF-NMC, 10/2 AWG, solid conductor insulated and jacketed with same compound, underground-feeder, non-metallic sheathed cable

· One vinyl compound for all–versatile OPALON* 1038

Remarkable physical and electrical properties qualify OPALON 1038 for scores of uses

A single insulating and jacketing compound now gives outstanding performance on a wider range of wire and cable applications than has ever been practical before. It is available to you *without* a premium price!

A unique combination of high insulating efficiency, excellent heat resistance and extreme toughness is responsible for the all-purpose versatility of Monsanto Opalon 1038 vinyl compound.

Opalon 1038 is widely used for U-L Type T, TW and exposure to oil at 60° C., as well as for U-L 80° C. appliance wire.

To simplify inventory and stock control, the same compound is recommended for both primary insulation and jacket in UF-NMC, underground feeder and non-metallic sheathed cable. It is especially good for machine tool wiring.

Rugged physical properties, including weather resistance and flame resistance, also qualify Opalon 1038 for insulating large-sized building wire (#6 AWG and over) and for cable jacketing.

All these applications have won appropriate recognitions from U-L, IPCEA, REA and Government agencies. For data sheets and complete information, write Monsanto Chemical Company, Plastics Division, Room 667, Springfield 2, Mass.

MONSANTO

*OPALON: REG. U. S. PAT. OFF.

The Plastiscope

trimethylolpropane contributes to better adhesion, color, color retention, and hardness. It also affords greater mixing ease in compounding polyesters and prepolymers with diisocyanates.

Citric acid derivative

Triallyl citrate, a new industrial chemical, has been made available to industrial researchers by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn, N. Y. A derivative of citric acid, the new chemical is considered to be particularly useful in the plastics industry as a cross-linking agent for polyester resins.

A highly unsaturated, reactive monomer which may be polymerized to hard, brittle thermoset polymers, triallyl citrate is another in Pfizer's continuing series of industrial chemicals produced, derived from, or made directly by the fermentation process. It is immiscible with water and miscible with acetone, benzene, chloroform, dioxane, ethanol, and glacial acetic acid.

Expanded Teflon line

Flexible thin-walled and spaghetti Teflon tubing in a variety of sizes and colors has been added to its line of Teflon products by Sparta Mfg. Co., Dover, Ohio. Suggested uses include instrument tubing; electronic applications; wire sheathing; medical tubing; pharmaceutical or food streams; acid, solvent, or other corrosive streams; fuel return lines; sterilization steam or other high-temperature lines.

Printable vinyl tape

Specifically designed for printing and die cutting applications, a new vinyl tape backed with pressure-sensitive adhesive has been announced by Minnesota Mining & Mfg. Co., St. Paul, Minn.

The tape, a printable version of tape No. 471, is intended for printed labels and seals resistant to chemicals, heavy wear, and limited weathering. It is expected to find use for fluid line identification in aircraft, coding, and identification in oil refineries, chemical plants, and pipe lines, and as printed designs for sporting goods.

Tensile strength in tape No. 471 is 21 lb./in. of width; adhesion is 24 oz./in. of width. The company states that both factors give added stress resistance which reduces telescoping when the tape is rewound after printing and prevents it from stretching during die cutting operations.

Percent elongation at break is 150. The product is produced in 36- and 108-yd. rolls in widths of ½ in. and wider, 6.5 mils thick. Widths of less than ½ in. are available in 36-yd. rolls.

Polyurethane stripper

Isothane polyurethane stripper, a scientifically compounded noncorrosive solvent-type stripper developed to promote the removal of polyurethane reaction products from ferrous and non-ferrous metals, has been announced by Surface Chemicals, Inc., 1005 Liberty Ave., Pittsburgh 22, Pa.

The polyurethane stripper may be applied by dip, flow coat, brush, or spray. Its action is complete after a very short contact period. Simple solvent wash after stripping will give recoatable surfaces. The product is available in 1-gal., 5-gal., and drum quantities.

Reinforced plastics window

Effective sunlight penetration is provided by a new glazing material developed by Reinforced Plastic Div., The Firestone Tire & Rubber Co., Akron, Ohio. Molded of pigmented fibrous glass-reinforced polyester resin, the panes are claimed by Firestone engineers to transmit up to 50% of visible light while filtering out ultra-violet rays.

The panes, which are intended to replace painted glass, have many potential uses in homes, but their first applications are for industrial buildings, factories, and warehouses where plastics, textiles, rubber, chemicals, and other materials that can be damaged by ultra-violet light are made and stored.

Firestone engineers state that while original price of the panes will be more than that of ordinary glass, the savings they will bring in replacement and maintenance costs will give the reinforced plastics windows an economy advantage.

Auxiliary stabilizers

Two new auxiliary vinyl stabilizers—Advastab XCH-101 and Advastab XCH-201—polymeric organic phosphorus derivatives of the chelating type, are available from Advance Solvents & Chemical Div., Carlisle Chemical Works, Inc., 245 Fifth Ave., New York, N. Y.

The main advantages claimed for XCH-101 and 201 are their lower volatility, lower odor level, and improved performance. The stabilizers are particularly effective in the presence of barium, cadmium, barium-cadmium, and barium-zinc compounds. The price is 70¢ a pound.

Phenolic coating

For heavy-duty maintenance, a 12-mil protective phenolic surface can be produced with only two coats of Phenoline 305. The material, recommended for use on structural steel, various types of equipment, exteriors, ceilings, and concrete floors in corrosive environment, has been developed by Carboline Co., 331 Thornton Ave., St. Louis, Mo.

Phenoline 305, a modified phenolic having 86% solids content, applies at 6 mils per coat and is catalytically set. The high solids content is claimed to result in a dense, non-porous film. Coverage is 200 sq. ft. per gallon.

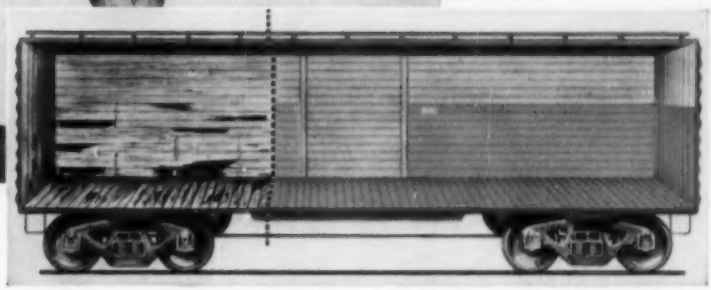
Tape-form epoxy

Epoxy resins for primary electrical insulation are now available in tape form from Minnesota Mining & Mfg. Co., St. Paul, Minn. The tapes, designated X-1035 (a glass cloth) and X-1045 (a non-woven polyester mat), are impregnated with an uncured epoxy resin. After oven cure, the

"Beat-up boxcars made like new with Espey Carliner!"

Reichhold polyester resin used in Espey Carliner is applied over glass cloth on floor of freight car. The resin coating goes on easily, dries fast to a hard, durable surface.

Low-cost lining provided by Espey Carliner covers cracks, gouges, oil spots. It seals seams, joints and corners against moisture and vermin. Old car is transformed into top-revenue carrier.



Tough RCI resin coating upgrades old cars in just a few hours!

● The heavy industrial equipment transported by railroads splinters and spoils wooden walls and floors of freight cars. This wear-and-tear progressively downgrades the cars to class C or D — cars unsuitable for commodities like edible grains.

Now, however, the Espey Carliner, developed by Spring Packing Corp. of Chicago with technical help on resin coatings from Reichhold, returns these cars to "class A" status. *In fact, Carliner treatment actually results in car walls and floors that are "better than new!"*

Two coats of special RCI polyester resin, brushed onto glass cloth, do the job quickly and economically. The resulting interior surfaces are *harder, more durable, more easily cleaned, provide better insulation, and are more resistant to moisture and chemicals than the original wooden walls and floors.* The lining is unaffected by freezing, heat, corrosion or shock.

"Reichhold was a great help to us with technical service" says John T. Landreth, president of Spring Packing. "They worked closely with our people, tailored just the right polyester resin formulation for our need. And they make fast deliveries, too!"

Whether *you're* interested in plastic coatings, molded or laminated plastics, RCI Technical Service can find a resin formulation that gives *you* important advantages, too! Write RCI about polyesters for your products. And ask for *booklet A.*

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The Plastiscope

resin sets into a hard, homogeneous mass around the protected unit providing mechanical support and a moisture barrier. When used at room temperatures, the tapes feel smooth and plastic and are said to leave no residue or pigment on the workers' hands.

The tapes are designed to meet Class B electrical insulation performance requirements. They have elongation characteristics which may be used to advantage during application to produce a shrinkage on cure. This shrinkage is reported to permit a tight, void-free build-up of insulation without the use of molds.

Molding bags

Silicone-modified rubbers and compositions of elastomers, reinforced and modified by silicone oil-filler dispersions, are being produced by Stoner Rubber Co., Inc., Anaheim, Calif. The materials are of interest to the low-pressure laminating field for use as bags and blankets in bag molding.

Plastics boats for Navy

A contract for the construction of 28 reinforced plastics motor whaleboats has gone to Wizard Boats, Inc., Costa Mesa, Calif., according to a Navy announcement.

The 26-ft. reinforced plastics whaleboats are considered to be superior to the wooden type in several ways: deterioration resulting from outdoor storage is practically eliminated; the boat is highly resistant to decay fungus; and repairs, when required, are easy to make.

New lubricant

Designated Aquacal, a stable 45% aqueous dispersion of calcium stearate is recommended by Beacon Chemical Industries, Inc., 33-51 Richdale Ave., Cambridge, Mass., as a general lubricant for extrusion and molding operations. A thixotropic paste, it can be diluted to any use concentration and is applicable in most processes using calcium stearate, which require (or can tolerate) the presence of water.

The dispersion is said to eliminate dust, inconvenience, fire, and some of the other problems of powdered calcium stearate.

Management performance

Six plastics manufacturing firms have been listed by American Institute of Management's 1956 Manual of Excellent Managements. Each is listed as deserving particular merit for excellence in one of the Institute's areas of management appraisal.

The companies gaining such recognition were Du Pont, Olin Mathieson Chemical Corp., Union Carbide and Carbon Corp., B. F. Goodrich Co., Monsanto Chemical Co., and Eastman Kodak Co.

Pipe sealing compound

A Teflon-based pipe joint compound for service up to 212° F., claimed to seal practically all known highly corrosive liquids and solvents, has been developed by Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

Known as John Crane Chemlon pipe joint compound, the sealant, because of the characteristics of Teflon, has a low coefficient of friction, permitting connections to be drawn up to a greater degree of tightness without excessive stress or strain.

The company states that pipe joints sealed with the new compound can be quickly and easily disassembled, even after years of severe service. Chemlon pipe joint is particularly adaptable for use on plastic, aluminum, stainless steel, and Monel pipe and is currently available in 2-oz. screw-type jars.

Sandwich panels

Structural panels of phenolic-impregnated kraft paper honeycomb and Conolite (polyester-paper and polyester-fibrous glass) faces are now being produced in effectively continuous lengths by Honeycomb Div., Continental Can Co., 100 E. 42nd St., New York, N. Y. Both the honeycomb and the Conolite facing are produced in continuous lengths, with maximum size of panel controlled by the size of the bonding press. The hot press used by the company is capable of producing panels 200 in. long by 48 in. wide. This size permits seam-free application of the new laminate to all kinds of home and office furniture and paneling needs.

Lacquer solvent

Ethyl amyl ketone (EAK), a new high-boiling lacquer solvent, is now available in unlimited tank-car quantities, according to an announcement by Shell Chemical Corp., 50 W. 50th St., New York, N. Y. It is claimed that EAK is a better solvent for nitrocellulose than any other high-boiler commonly used. The solvent also finds application in vinyl coatings and as a starting point for chemical syntheses. It is priced at 17½¢ a lb. in tank-car quantities.

Expansion

Naugatuck Chemicals, Div. of Dominion Rubber Co., Ltd., is building a major extension which will quadruple the amount of laboratory space available at its Elmira, Ont., plant.

Features of the new laboratory will include an emulsion polymerization section for the development of high styrene resins, gum plastics, and related polymers. This section will be equipped with bottle polymerizers and complete facilities for handling butadiene and other gaseous raw materials.

Another section will be devoted to plastics and rubber evaluation, to meet the increasing demand for technical service to customers in those fields. Among the activities of this section will be the development of improved application methods for Vibrin, Naugatuck's polyester resin, and Kralastic, which Naugatuck calls a "new gum plastic."

The General Tire & Rubber Co., Flooring Div., has doubled its manufacturing capacity at Jeannette, Pa., where it will produce

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1

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(dry colorant)

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★ Iridescent

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3

for
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its new Terrazzo vinyl floor tile as well as plain and marbleized Bolta-Floor.

Harwick Standard Chemical Co. has started construction of a quarter-million-dollar building on S. Seiberling St., Akron, Ohio, to provide 33,000 sq. ft. of additional space for warehouse and general office requirements.

Stillman Rubber Co., Culver City, Calif., has acquired **Plasticast, Inc.**, 1421 First St., San Fernando, Calif. To be operated as the Plasticast Div. of Stillman Rubber Co., the new organization will concentrate on polyvinyl dipping and coating, slush molding, injection molding of plastisols, production of open- and closed-cell foam vinyl, and rotary casting. **Philip Keller** is general manager and **George Selby** factory representative.

Mayflower Electronic Devices, Inc., manufacturer of electronic sealing equipment, has moved from 6014 Hudson Blvd., West New York, N. J., to its new 28,000-sq. ft. plant at 20 Industrial Ave., Little Ferry, N. J.

Stein, Hall & Co., Inc., plans a quarter-million-dollar plant, laboratory, and office building at Charlotte, N. C. The new facilities will supply resins for industrial applications and formulations for warp sizing, printing, finishing, and other operations in textile production. In addition, the plant will produce a complete line of liquid adhesives.

Fabricon Products, Div. of The Eagle-Picher Co., has tripled production of its Lamin-Art plastic laminate by its recent move to expanded facilities in a new $2 million plant at 6430 E. Slauson Ave., Los Angeles, Calif.

Lushan Co. has expanded production facilities at its new plant at 71 Elm St., Waltham Branch, Boston, Mass. The company offers press-polished flexible and rigid laminates to the automotive, handbag, shoe, lampshade, eyeglass, and other novelty trades, as well as for special applications.

Schori Process Div., Ferro-Co Corp., 6-11 43rd Rd., Long Island City, N. Y., is erecting a new building adjoining its present plant at 59-31 54th St., Maspeth, N. Y. This will bring the area available for production to 60,000 sq. ft., almost doubling the present space. The company fabricates fibrous glass-reinforced laminate structural materials (Iolyte) into tanks, crocks, ducts, stacks, and exhaust systems. All work is done to specifications.

Lustro Tile Products Corp., Akron, Ohio, will more than double its present production facilities for wall tile. New production equipment will be installed in the new plant and the work force will be stepped up by at least one third to operate the new machines.

Lustro will soon market several new products now under development. Currently, the firm is carrying on a campaign to promote Deluxe Crown Contour, a new plastic tile line that gives a quilted appearance and meets all requirements for FHA loans.

Evans Research & Development Corp., 250 E. 43rd St., New York, N. Y., chemical consultants, is launching an over-all expansion program, including an increase in research personnel, expanded laboratory space, and new tools of research. Expansion in the plastics department includes the addition of new heat distortion, tensile testing, and heavy-duty mixing equipment.

Architectural Plastics Corp., 1355 River Rd., Eugene, Ore., is selling 4568 shares of common stock to continue expansion of regional distribution of plastic building materials. Expansion of its two divisions, **Plasti-Products Co.** and **Design Industries**, is also scheduled. Current program involves enlarged inventories of materials, additional geographical coverage, and an accelerated research and engineering program.

Deceased

Richmond C. Quortrup, assistant manager of the Chemical Sales Dept. of **Barrett Div., Allied Chemical & Dye Corp.**, died at the age of 57. He had been with the company since 1917.

Meetings

Plastics groups

June 26: The Society of the Plastics Industry, Inc., Plastic Structures Division Conference, Hotel Roosevelt, New York, N. Y.

October 11-12: The Society of the Plastics Industry, Inc., New England Section Conference, Wentworth Hotel, Portsmouth, N. H.

Other meetings

July 8-13: New York Lamp Show, Hotel New Yorker and Trade Show Building, New York, N. Y.

July 10-12: Sixth Western Packaging and Materials Handling Exposition, Pan Pacific Auditorium, Los Angeles, Calif.

August 26-30: National Association of Furniture Manufacturers, Supply, Equipment, and Fabric Fair and Convention, Conrad Hilton Hotel, Chicago, Ill.

September 9-12: American Institute of Chemical Engineers, Meeting, William Penn Hotel, Pittsburgh, Pa.

September 10-12: Packaging Machinery Manufacturers Institute, Eighteenth Annual Forum, Hotel Statler, Cleveland, Ohio.

September 11-14: Packaging Machinery & Materials Exposition of 1956, Public Auditorium, Cleveland, Ohio.

October 21-24: Society of Industrial Packaging and Materials Handling Engineers, Eleventh Annual Protective Packaging and Materials Handling Exposition, Kiel Auditorium, St. Louis, Mo.

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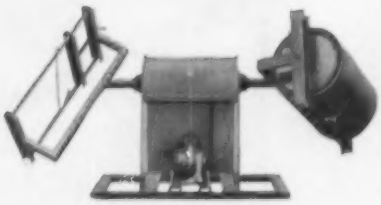

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Combining economical operation and maintenance with a highly efficient mixing action, the TB 34 provides thorough dry blending for every purpose.

AVAILABLE FROM STOCK WITHOUT DELAY

Length	96"
Width	48"
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Approximate Wt. 350 lbs.

Motor ¾ hp. Phase 3

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Capacity 250 lbs.

Drum Cradle Size—

Diameter ..... 23"

Height ..... 32"

Price $465 FOB Fanwood, N. J.

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Company Notes

National Starch Products: Donald D. Pascal elected executive vice president to succeed the late A. A. Halden. **Robert A. Bintz** and **Lester Klempner** named assistant vice presidents. **Berkley V. Schaub** elected president of **National Adhesives (Canada) Ltd.**, an affiliate of National Starch Products.

Allied Chemical & Dye Corp.—National Aniline Div.: Ross M. Sims appointed plant manager in charge of all operations of the Moundsville, W. Va., plant which produces maleic anhydride and fumaric acid. Three superintendents of engineering have been named—**D. A. Feil** at the Chesterfield, Va., plant; **D. A. Aubrecht** at the Moundsville, W. Va., plant; and **William M. Holtzclaw** at the Buffalo, N. Y., plant.

Barrett Div.: George H. Martin named Canadian sales manager in the Montreal and Toronto districts for Plaskon urea, melamine, alkyd, and nylon molding compounds. Two appointments made at Glendale Plaskon Laboratory, Toledo, Ohio: **H. E. Murray**, technical specialist for molding compounds, synthetic glues, paper-treating resins, and reinforced plastics. He has been associated with Plaskon resin and plastics products since 1932. **James J. Moylan** has been named assistant supervisor and will be in charge of technical service for molding compounds.

The Dow Chemical Co.: F. J. MacRae appointed assistant manager of the entire Plastics Technical Service group. Directly responsible to Mr. MacRae will be **R. J. McDonald**, office and supplies manager, and the following three field section managers: **E. E. Merrill, L. E. Tallman, and R. W. VanSickle.**

The PTS-Midland section has been divided into three basic groups — Fabricated Products (film, expanded plastics, and sheet), Molding Materials (molding; extrusion, including calendering; and engineering and mechanical development), and Testing and Evaluation (formulation, testing, and special product development). **E. E. Ziegler,** former head of Testing, is now in charge of Fabricated Products; **G. W. Cheney**, formerly in charge of Extrusion, now heads Molding Materials, with **R. E. Monica,** former Calendering section head, succeeding Mr. Cheney. **Gordon B. Thayer** continues as head of the Molding section; **D. B. Semeyn**, previously development engineer on the Heat Fabrication staff, heads the Engineering and Mechanical Development section; **P. H. Lipke,** formerly in charge of Formulation, is now in charge of Testing and Evaluation. In this group, **W. E. Brown** will be responsible for Testing, succeeding Mr. Ziegler; **H. W. Wehr,** formerly with the Molding section, is now in charge of Formulation; and **J. A. Struthers,** previously with the Molding section, will be in charge of the newly created Special Products Development section.

Dow has moved its St. Louis, Mo., sales office from 3615 Olive St. to 10 S. Brentwood Blvd. **Glenn H. O'Neal,** with the company for 32 years, is manager of the office.

The Baker Castor Oil Co.: J. W. Hayes, new sales manager in charge of over-all sales activities, has been with the company since 1946. **L. J. Jubanowsky,** with Baker since 1942, now eastern sales manager responsible for sales east of the Rocky Mountains. **R. L. Vignolo,** new Pacific Coast sales manager west of the Rocky Mountains, has been with the company since 1950. **R. E. Rulison,** who has been with Baker Castor Oil since 1941, is district sales manager for the Chicago area.

Plax Corp.: Grant S. Brown, formerly with Western Electric Co., Inc., named research manager; **Robert G. Strauss** and **Richard J.**

Morcom assistant research managers. Mr. Strauss will be responsible for blownware engineering and Mr. Morcom for extrusion engineering. **Edwin L. Fuerst,** design and packaging specialist, joined the company as special assistant to the vice president in charge of sales.

Mobay Chemical Co.: Clois R. Morton, formerly with Monsanto's Lion Oil Co. Div., named production supervisor of the Phosgenation Dept. at the New Martinsville, W. Va., plant. **J. William McCrackin,** previously manufacturing superintendent at Monsanto's John F. Queeny plant, now a technical service representative. **Horace O. Kippels,** formerly with Monsanto Chemical Co., appointed a senior in the Design Engineering Dept.

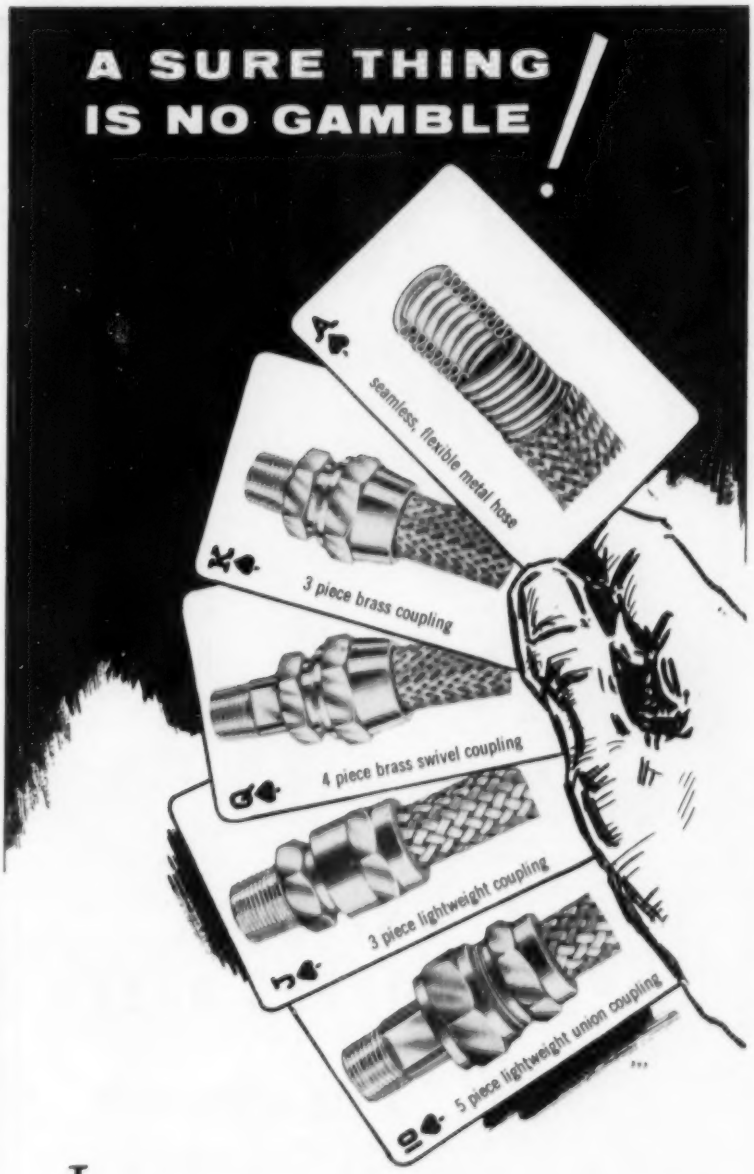
Pittsburgh Plate Glass Co., Fiber Glass Div.: Robert A. McLaughlin, with the company since 1939, named general manager. **P. Dudley Kaley** now manager of sales; and **Orville Miller, Jr.** appointed manager of superfine products sales.

Reichhold Chemicals, Inc.: F. Albert Smiles, director of technical service, named general manager of the Elizabeth, N. J., plant, succeeding **Dr. S. H. Baum** recently elected executive vice president.

General Electric Co.: Four appointments in the engineering section of the Silicone Products Dept.: **Dr. Stuart D. Brewer,** manager—resin product engineering; **Dr. Frederick M. Lewis,** manager—advance development; **Dr. Abbott Pozefsky,** manager—analytical and control methods unit; and **Dr. William F. Gilliam,** specialist—technical information exchange.

Union Carbide—Carbide and Carbon Chemicals Co.: New district managers: **R. A. Corio,** Newark, N. J.; **B. A. Gustin, Jr.,** Boston, Mass.; **R. J. Hughes,** Philadelphia, Pa.; **J. F. Luther,** Charlotte, N. C.; and **J. R. Retter,** Albany, N. Y.

Celanese Corp. of America: C. H. Litz named assistant sales director of the Plastics Div.'s Sheet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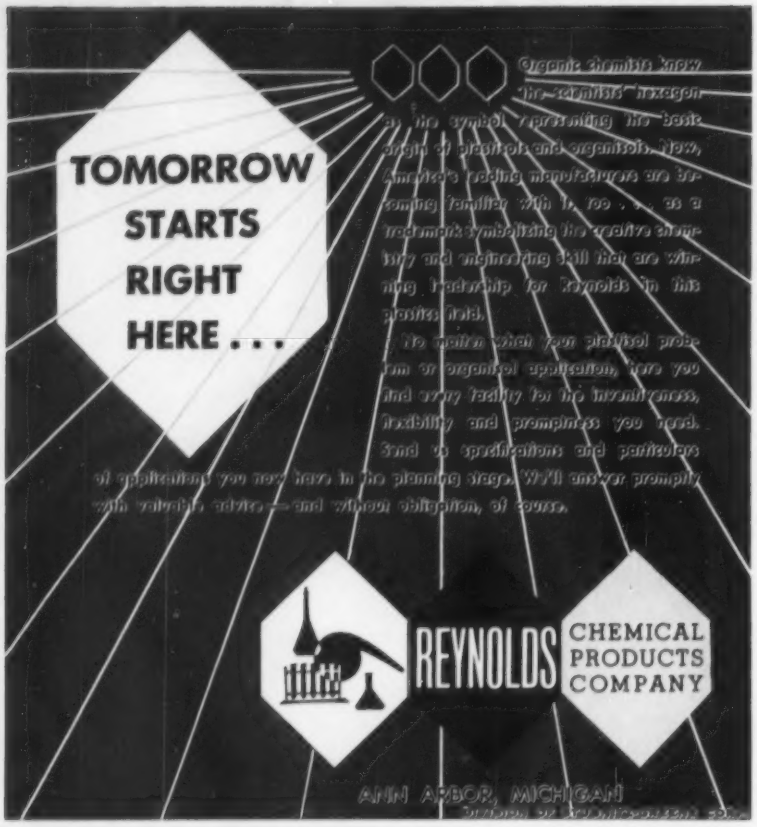

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Company Notes

and Molding Materials Dept., responsible for sales of extruded cellulose acetate sheet. He has been with the company for 15 years. **Howard Jerome**, formerly with E. F. King Co. and Moderne Paint Co., is Midwest technical sales representative for polyvinyl acetate emulsions.

Metal & Thermit Corp.: H. D. McLeese, new vice president, will direct sales, market development and research, and advertising of all Metal & Thermit products as well as of its affiliate, **United Chromium, Inc.**

General Coating Co., Woodbridge, N. J., has been appointed a franchised applicator of Unichrome 5300 series sprayable plastisols. General Coating, an organic coatings applicator for over 10 years, had been engaged in dip plastisol operations for several months prior to the appointment.

Polyvinyl Chemicals, Inc., Peabody, Mass., formerly a division of Stahl Finish Co., now incorporated as a separate entity, manufactures acrylic copolymer emulsions and specialty vinyl-acetate copolymers. **Max Potash** is president; **Harold Naidus**, vice president in charge of development; **Samuel S. Stahl**, vice president; and **Louis E. Stahl**, secretary-treasurer.

Colton Chemical Co.: Sales and service territory under Chicago district manager **James K. Ames** has been expanded to include Minneapolis, St. Paul, Kansas City, St. Louis, and Wichita. **David M. Stettler** appointed to assist Mr. Ames in sales and technical service.

Charles J. Vickers, formerly with Allied Chemical & Dye Corp., now manager of technical sales and service of the Colfoam Microballoon Spheres Dept.

U. S. Polymeric Chemicals, Inc. has opened a new plant at 700 E. Dyer Rd., Santa Ana, Calif. **E. J. Van Dycke**, formerly with Cheney Bros., is general manager and

Robert Burton sales manager. The company produces resin-impregnated paper, glass cloth, and glass mat used for laminating.

Hydraulic Press Mfg. Co.: Plans for the merger of Hydraulic Press Mfg. Co. and **Koehring Co.** are being submitted to stockholders of both companies for ratification. H-P-M manufactures hydraulic presses and injection and compression molding machines. No change in personnel or operation is contemplated for H-P-M. Koehring is a specialist in concrete-handling equipment.

New England Laminates Co., Inc. (Nelco) has acquired **Rowland Laminates, Inc.**, 481 Canal St., Stamford, Conn., which was formerly the Plastilight Div. of Rowland Products, Inc. Nelco offers a variety of sizes in all laminates up to 48 by 80 inches.

Foster Grant Co., Inc.: Four new staff members added: **E. Glenn Clackum**, chief of color control in quality control laboratory, comes from National Plastic Products Co. **Ross H. Supnik, Stanley H. Howard**, and **Melvin Silberberg** named research group leaders to head up work on new products and new process developments. Mr. Supnik was formerly with Monsanto Chemical Co; Mr. Howard with Du Pont; Mr. Silberberg was previously director of polymer research of Technical Tape Corp.

Phillips Chemical Co.: New district sales office of Plastics Sales Div. established at Bartlesville, Okla., to serve the southwestern and southern states, with **R. F. Uber** as manager. **D. W. Thornburg** promoted to plastics sales engineer in the New York district office.

Escambia Bay Chemical Corp.: R. U. Haslanger, vice president and general manager, elected to board of directors. **A. N. Wohlwend**, formerly with Stauffer Chemical Co., now director of commercial development.

Heli-Coil Corp.: Eduard Baruch appointed president, succeeding **Louis R. Ripley** who is now chair-

2
1
3
Thousands of these miniature XK120 Jaguars (1) are molded each hour from multiple steel cavities (2). These hobbings are produced rapidly and with a minimum of machining from a single master hob (3).

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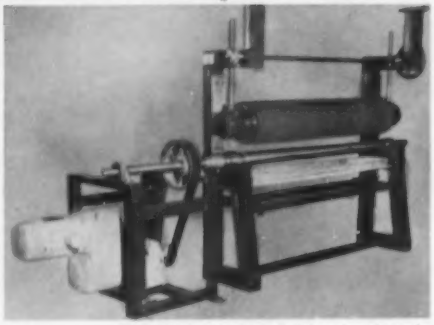

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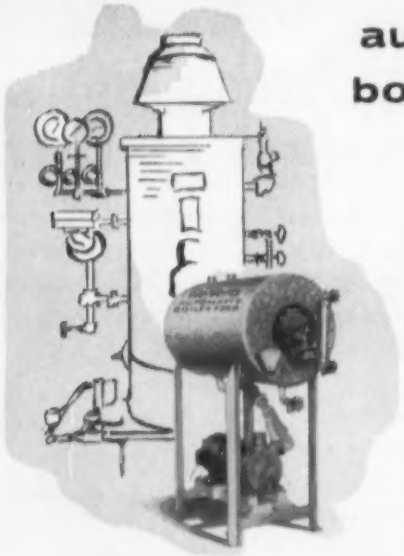

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Company Notes

man of the board; **Walter Mann** named executive vice president. Mr. Baruch was instrumental in forming the company which produces wire thread inserts to provide strong, wear-resistant threads in plastics, aluminum, and magnesium.

Archer-Daniels-Midland Co.: Erwin A. Olson to newly created position of administrative vice president; **Richard G. Brierley,** newly elected vice president, succeeds Mr. Olson as manager of the company's **W. J. Small Div.; John Daniels** succeeds Mr. Brierley as head of production and procurement in the division.

Claude P. Bamberger, Inc. and its affiliate, **Claude Bamberger Molding Compounds Corp.,** have moved from 152 Centre St., Brooklyn, N. Y., to larger quarters at 1 Mount Vernon St., Ridgefield Park, N. J. The new facility will permit Bamberger to reprocess plastic materials in greater volume than heretofore.

The Wrenn Paper Co., Middletown, Ohio, has turned over all its processes, converting equipment, etc., used in the manufacture of various grades of Wrenn's blotting paper, to **Sorg Paper Co.** The entire capacity of the Wrenn mill will now be devoted to the making of saturating papers for the laminated plastics industry.

Jason Corp.: Ralph Leonard, now on the executive sales staff of the Automotive Div., was formerly active in the auto trim field. **Andrew Schwartz,** formerly with Southbridge Finishing Co., is sales supervisor for New York and New England states. Four regional appointments to the general sales staff are: **Jack Boyajian,** Boston; **John Dowdell,** Chicago; **Robert Rheuban,** Philadelphia; and **Jules Nadell,** New York City.

Continental Can Co.: Ralph F. Cox now Boston sales representative for the Shellmar-Betner Flexible Packaging Div. Richard K. Shelby, named assistant to the

executive vice president of the Non-Metal Divs., will handle coordination and development of the plastic projects and products of the company's various divisions.

Amphenol Electronics Corp., 1830 S. Fifty-fourth Ave., Chicago, Ill., is the new name of the firm formerly known as American Phenolic Corp. The change of name does not alter the identity or character of the corporation.

Sommers Fabrics Corp., 7-9 W. 18th St., New York, N. Y., announces the registration of the tradename Roller Patent for its exclusive use in the distribution of Alkor Star plastics produced by **Alkor GMBH,** Munich, Germany. Sommers is a converter and distributor of vinyl sheeting.

Standard Plastics Co., 442 W. Garfield Blvd., Chicago, Ill., has been recently organized to engage in vacuum forming.

Fabric Leather Corp. has opened a West Coast branch at 1139 Santee St., Los Angeles, Calif., with **Lou Kirsch** as manager. The company will maintain complete inventories of Du Pont Fabrilite vinyl upholstery for the upholstery and automotive trades.

Vinyl Fabrics Institute, representing 19 leading producers of vinyl fabrics, has moved from 9 Rockefeller Plaza to 65 E. 55th St., New York, N. Y. The Institute's new location will serve as headquarters for an expanding consumer education and public relations program, as well as offices for staff members and committee meetings.

Nopco Chemical Co.: D. E. Murphy assigned to the technical sales staff on the West Coast.

The Cedartown, Ga., plant will be closed from July 1 through July 15 for vacation; the Harrison, N. J., plant from August 12 through August 26.

Mira Plastics Co., Inc., 50-54 Illinois Ave., Paterson, N. J., molder of plastics products, is the new name of the company formerly known as Plastic-Craft Mfg. Co.

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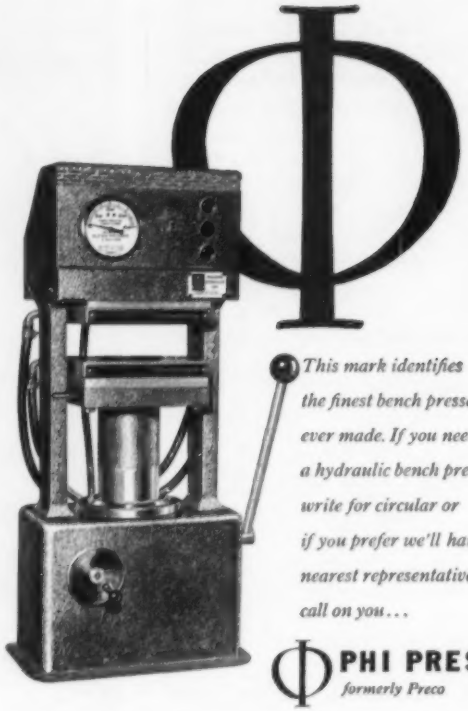

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Personal News

Charles W. Kleiderer appointed vice president of sales and a member of the board of directors of **Penn-Plastics Corp.**, Glenside, Pa. Mr. Kleiderer has been in the plastics industry for 19 years and was most recently sales manager of Brilhart Plastics Corp. During World War II, he worked with the government's Office of Scientific Research and Development and was particularly concerned with the development of plastics parts for the proximity fuse.

Penn-Plastics is expanding its molding operations which have been engaged primarily in producing molded parts for the electrical and allied fields.

Harry N. Stevens has been named director of research operations of **B. F. Goodrich Co.**

Anthony J. Bruno, Jr., formerly chief engineer of Escambia Chemical Corp., Pensacola, Fla., named technical manager of the Grex polyolefin resin plant of **W. R. Grace & Co.'s Polymer Chemicals Div.** now under construction in Baton Rouge, La.

Eugene S. West, formerly plant manager of Remco Industries, Inc., Irvington, N. J., named plant manager of **The Polycast Corp.'s** factory in Stamford, Conn. Polycast manufactures cast sheets of acrylic, allyl, and copolymer resins in clear, translucent, and colored materials.

E. Wayne Haley is now assistant to the president of **Columbia-Southern Chemical Corp.**, a subsidiary of **Pittsburgh Plate Glass Co.**, and a vice president and director of **Pittsburgh Plate Glass Export Corp.**, in charge of chemicals exports. Mr. Haley has been associated with Columbia-Southern in an executive sales capacity since 1934.

John D. Cochrane, formerly director of research, now technical director in charge of the development and manufacture of resins at **The Formica Corp.** The new position will coordinate Formica's resin activities with those of the parent company, **American Cyanamid Co.** Mr. Cochrane played a major part in the development of decorative laminates from natural and synthetic resins. He received the Hyatt Award in 1947 for service to the plastics industry.

Joseph E. Dierkes, formerly with Acheson Dispersed Pigments Co., has joined the colloidal dispersions unit of **Columbian Carbon Co.** in charge of control and production at the firm's new Tacony (Philadelphia) plant.

Harry P. Schrank, production vice president of **Seiberling Rubber Co.** since 1936, promoted to executive vice president.

William F. Barrett named assistant production superintendent of **Consoweld Corp.**, Wisconsin Rapids, Wis.

Howell D. Chickering to eastern district sales manager of **Du Pont**, with headquarters in Philadelphia, Pa., succeeding Veasey C. Clark, retired.

Dr. Ralph F. Nickerson, formerly with Monsanto Chemical Co., now a group leader of **Shawinigan Resins Corp.**, Springfield, Mass., will direct the firm's textile and paper coatings program.

Charles M. Simmons is now New York state district manager of **Heli-Coil Corp.**, Danbury Conn., following the resignation of Beemer Engineering Co. as Heli-Coil representative for the area.

Ralph L. Poskitt promoted to research and development manager of **Minnesota Mining & Mfg. Co.'s Adhesives and Coatings Div.**

Albert E. Forster, president and chairman of the board of **Hercules Powder Co., Inc.**, has been named recipient of the 1956 Memorial

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Like this metal expansion joint, a number of surfaces can be given corrosion-resistant, protective coatings with the new *dispersion* form of KEL-F fluorocarbon plastic.

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A unique combination of properties of the coatings suggests many areas of use:

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ANTI-STICKING – agitators, calender and guide rolls, forming dies, cone blenders, casting molds.

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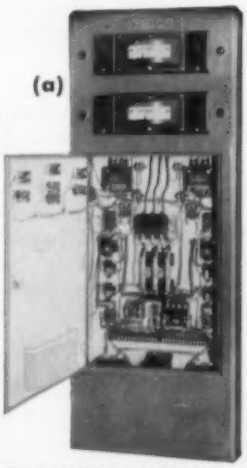
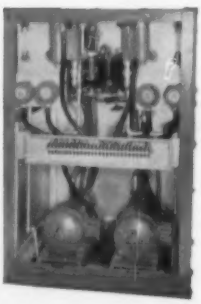
- **MODEL H AUTOMATIC THERMOLATOR**—Shown at right. Completely automatic operation, for permanent installation. Controls can also be integrated in Master Instrument Control Panel with other press and mold controls by instrument manufacturer, affording most efficient supervision.

Model H THERMOLATOR is manufactured under U.S. Pat. 2,632,088, and is built to conform to JIC standards.

(a)



(b)



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Personal News

Award of the **Chemical Market Research Association** for his contributions to market research in the chemical industry.

Thomas C. Ackerly named sales manager of **Brilhart Plastics Sales Corp.**, Mineola, N. Y. He has been with the firm for five years.

Joseph Mazia has resigned as president and general manager of Orma Corp., Beltsville, Md., and has gone back to consulting engineering at 1605 Connecticut Ave., N.W., Washington, D. C. He will serve the fields of reinforced plastics, protective coatings, and corrosion engineering.

Harry G. Lake appointed commercial engineer of **Mycalex Corp. of America** for the east central district, with headquarters at 2138 Lee Rd., Cleveland Heights, Ohio. Mr. Lake will also represent **Mycalex Electronics Corp.**, **Mycalex Tube Socket Corp.**, and **Synthetic Mica Corp.**

James S. Thornton, formerly West Coast representative, now sales engineer of **Frank W. Egan & Co.**, producer of paper converting, plastic film, and air drying equipment. Sales and service for the West Coast will now be handled by Egan's new plant and main office in Sommerville, N. J.

Claud Brown, elected a vice president of **Interchemical Corp.**, will also continue as treasurer.

George J. Forman named Cleveland, Ohio, representative for **Ansbacher-Siegle Corp.**, Rosebank, N. Y., manufacturer of colorants.

William Kriewall, formerly with Permagile Corp. of America, now sales engineer of **American Agile Corp.** covering southern Ohio and western West Virginia.

James W. Elliott appointed to the sales and service staff of **The O. Hommel Co.'s Southeastern Div.** The company, among other things, makes colorants for plastics.

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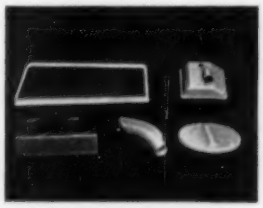

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NEW ARRIVALS FOR SALE: French Oil Mill Machy. Compression Molding Presses; 75-170 tons, 3-170 tons, 35"x18", 5-95 tons 29"x18", 3-75 tons 18"x17", 5 Preheaters 2 KW, Wood 20"x20" 12" ram 170 tons; Southwark 24"x24" 12" ram, 170 tons; Baldwin Southwark 4-26"x26" 8" rams, 75 tons; 5-26"x26" 7" rams 57.7 tons; 2-15"x15" 8" rams 75 tons; 2-19"x24" 10" rams, 78 tons; 2-12"x12" 7½" rams 66 tons; 2-D&B 12"x12" 7" rams, 57.7 tons; 8"x9" 4½" rams, 24 tons; D&B 12"x12" 3" rams, 10 tons; HPM Transfer Molding 75 tons; Preform Presses, Colton 5½T Stokes R and DDS-2 MD; New Universal Dual Pumping Units 3-15 HP; Lab. Mills and Calenders; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. Universal Hydraulic Machinery Co. Inc., 285 Hudson St., New York 13.

FOR SALE: (2) 300 Ton W.S. Presses 20x 20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. 250 Ton W&S 28x24 Platens, 80 Ton Farrel 24x24 Platens. Many other Presses—Send for Bulletin. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

FOR SALE: 1—Royle #4 Extruder, motor driven; 1—6"x12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrel-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed-Prentice & W-S Injection Molding Machines, 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? Consolidated Products Co., Inc., 50 Bloomfield Street, Hoboken, N. J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all aux. equip. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 1111, Modern Plastics.

FOR SALE: (11) 75 ton record presses, complete ● $2,450, (11) new 100 ton, 10" ram, 10" stroke ● $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 ● $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 ● $1,650, (1) 50 ton complete, 18x18 ● $1,850, (1) 200 ton, 16" ram, 30x30 ● $2,450, (2) 200 ton, 16" ram, 42x42 ● $2,850, (1) 200 ton, 15" ram, 42x42 ● $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt ● $3,375. Hydraulic Sal-Press Co., Inc., 388 Warren Street, B'klyn, N. Y.

FOR SALE: 3—Ball & Jewell #2, #1½ Rotary Cutters; 1—Cumberland #0 Rotary Cutter; 4—Two Roll Mills 20"x22"x60", 15"x40", 6"x14"; 3—Baker Perkins 100 gal., 50 gal., 2 gal., jacketed double arm Mixers; 1—Stokes Rotary Preform Press #DDS2; 3—Stokes Model "R" single punch Preform Presses; 1—Kux Model 15-25 Rotary Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

AVAILABLE AT BARGAIN PRICES.
Baker Perkins 50 gal. cap. stainless steel steam jacketed heavy duty Mixers with stainless jacketed blades, motorized power tilting, motor driven. W&P 200 gal. heavy duty Mixer, tilting type, with sigma blades. J. H. Day from ¾ up to 100 gal., Imperial & Cincinnatus D.A. jacketed, sigma blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Gemco 2000 lbs. 56 cu. ft. Double cone Blender. Mikro Bantam, 18H, 1F, 2TH Pulverizers. Day, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2 RP & 3RP Rotary Tablet Machines. Carver Lab 20 ton hydraulic press. Package Machy. FA, FA2, FA4, Miller, Hayssen, Scandia, Hudson Sharp, Oliver Auto Wrappers —all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements.
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FOR SALE: Marco Process consisting of: Homogenizer, Roto-Feed Mixers, Reactors, Kom-Bi-Nators, Pumps, all stainless steel. Heavy Duty Double Arm Sigma Blade Mixers. (2) Readco 50 gal. 30 HP; (2) W&P 100 gal.; (2) J. H. Day 75 gal. stainless steel; (1) Banbury #3 with 75 HP motor. (2) Kux Rotary Pellet Presses. (4) Sprout-Waldron Horizontal Ribbon Mixers 336 cu. ft. (12,000#) capacity. (1) St. St. Pug Mill 7" dia. x 3'9" long overlapping chambers, jacketed 75#. (4) Mikro Pulverizers #2DH, #2TH, #3TH. (3) Fitzpatrick Stainless Steel Comminuting Machines, Models D, K & F. We Buy Your Surplus Equipment. Perry Equip. Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Lester Injection Molding Machines 4, 8, 12 and 16 oz.—W-S and Baldwin Hobbing Presses 150 to 2000 ton —Boiling Laboratory Presses 50 to 150 ton—Molding Presses and Pumps—new ¾" Hi-Speed Hydraulic 3000 psi Double Solenoid Hydraulic Control Valves—partial listing—we buy used plastic molding equipment. New 6"x12" M.P. Laboratory Mills. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J. Telephone DE 4-1615; Cable address "Plasmex-Boonton."

FOR SALE: 60 oz. H.P.M. w/1200 ton clamp; 48 oz. H.P.M., 1955; 48 oz. DeMattia; 32 oz. Lester, 1950, $22,000; 16 oz. Mod. E. Reed-Prentice, 1948, $13,000; 16 Impco vert. w/10 oz. cyl, $7,500; 16 oz. H.P.M., 1946, $11,500; 12/16 oz. DeMattia, fully hyd., 1951, $10,000; 12 oz. DeMattia, $7,500, terms; 12 oz. Lesters; 8 oz. Reed-Prentice, 1946, $7,000; 9 oz. H.P.M. w/12 oz. cyl, 1945, $7,500; 8 oz. Lester, 1946, $5,500; 8 oz. Leominster, 1946, $3,500; 6 oz. Reed-Prentice 1946, $6,500; 4/6 oz. Reed-Prentice, 1955, w/low pressure closing, fully aut., $10,500; 4 oz. Lester, 1953, fully aut., $8,500; 4 oz. Watson-Stillman vert. 1949, $5,000; 4 oz. H.P.M. 1948, $4,500; 4 oz. DeMattia vert. new; 3 oz. Fellows, 1951; 2 oz. Reed-Prentice, $1,500; 2 oz. Isoma, fully aut., $1,500; 2¾ oz. Clifton, new, $3,350; 2½ oz. Moslo Minijector; used cylinders, grinders; Model F Packaging machine; Auto. spraying machine; Stokes presses; all types new and used plastic machinery—Let us list your surplus equipment. Acme Machinery & Mfg. Co., 102 Grove St., Worcester, Mass.

FOR SALE: 2½" inch NRM Plastic Extruder with oil heating equipment, 6 inch Hartig Strainer with quick opening latch type door barrel 45 inch long with drive and motor and all controls, 6 inch Royle Plastic Extruder with oil heating equipment and drive and motor. All machines reasonably priced. Reply Box 1141, Modern Plastics.

FOR SALE: Hartig 3¼" Plastic Extruder. Stokes R, 2½", single punch, Preform Machine. Stokes 280-A, single punch, Preform Machine. Kux 2½" dia. single punch Preform Machine. Farrel 15"x36", 2-roll Mill. Mills and Calenders up to 84". New Seco 6"x13" and 8"x16" Lab. Mixing Mills and Calenders. Plastic and Rubber Extruders. Oxford 57" Slitter. HPM 1200 ton Laminating Press, 15 openings, 100"x 120". Brunswick 225 ton 21"x21" platens. Farrel 200 ton 30"x30" platens. 200 ton Hobbing Press 18"x14" platens. D&B 140 Ton, 36"x36" platens. D&B 150 ton, 24"x 24" platens. Adamson 80 ton, 20"x20" platens. Farrel 200 ton 20"x80" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Pumps and Accumulators. Stokes Automatic Molding Presses. Rotary and single punch Preform Machines, ⅛" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker-Perkins & J. H. Day Jacketed Mixers. Plastic Grinders. Gas Boilers. Partial Listing. We buy your surplus machinery. Stein Equipment Co., 107-8th Street, Brooklyn 15, New York. Sterling 8-1944.

BRAND NEW PHENOLIC MOLDING Compounding Plant: Output 1500-3000# per hr. for resin & filler to be converted to molding powder (phenolic) w/batch blenders, mixers, & other machy. New & in original crates. 150 T. W. Stillman semi-auto molding press, new '40, replacement value $18,000; slf-cntd. $3975. 50 T.W. Stillman Transfer Press new '44, 11" dia. ram, 12" stroke, platen 12"x18", top & side rams. $1975. 20 T. Elmes Lab Presses new '44, up acting w/steam & elec. htd. platens. Cored for steam & flexible lines. 8, 12, 16, 22 oz. Reed, HPM, W. Stillman, Lester Phoenix Injection Molding Machines. 1950 & later. Eveready: P. O. Box 638, Bridgeport, Conn., EDison 4-9471-2.

(*Continued on page* 226)

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(Continued from page 224)

FOR SALE: Hydraulic Presses: R. D. Wood 2500, 8-Opening, 54"x54" Steam Platens. HPM 1200 Ton, 15-Opening Laminating Presses, 100"x120", Platens, Slf.-cntd. Elmes 1000 Ton Hobbing, M. D. Pump. Baldwin Southwark 800 Ton, 10-Opening, 42"x42" Steam Platens. HPM 750 Ton. Down-Acting, 59"x44" bed, Slf.-cntd. Morane 669 Ton, 3 Upmoving Rams, 16" stroke. Farrel 625 Ton, 52"x52" Platens, Slf.-cntd. Watson-Stillman 600 Ton, Hobbing, M. D. Pump. Farrel 393 Ton, 2-Opening, 48"x48" Steam Platens. Elmes 350 Ton, Down-Acting 39"x36" Bed, Slf.-cntd. Lake Erie 300 Ton, 30"x30" Platens, Slf.cntd., Semi-Auto. Lake Erie 215 Ton, 36"x36" Platens, Slf.-cntd., Semi-Automatic. Carey 150 Ton, 21"x16" Platen, Adj. DLO 8"-28" (3). Lake Erie 100 Ton, Down-Acting, 24"x24", Bed, Hi-Speed, Slf.-cntd. Farquhar 100 Ton, Down-Acting 30"x28" Bed, Slf.-cntd. Farquhar 100 Ton, Drawing, Down-Acting, 29"x34" Bed, Hi-Speed, Slf.-Cont. HPM 100 Ton, Fastraverse, Down-Acting, 30"x 30" Bed, Slf.-cntd. Watson-Stillman 100 Ton, Down-Acting, 22"x20" Bed. Slf.-cntd. Watson-Stillman 100 Ton, Burroughs 75 Ton; HPM 35 Ton Molding Presses. Farquhar 75 Ton Up-Acting 30"x 42" Platens. Baldwin-Southwark 50 Ton, Angle Molding Press. Watson-Stillman 50 Ton, 12"x17" Elec. Htd. Platens. Farrel 50 Ton, 12"x12". Loomis 40 Ton, 4 Opening 12"x12" Elec. Platens. Francis 40 Ton, 4-Opening, 12"x12" Elec. Htd. Platens. Baker 30 Ton Full Auto., 21"x26". Watson-Stillman and Elmes 30 Ton and 20 Ton Lab Presses. Stokes Model 200D-2, 15 Ton Auto. and Stokes 300, 200, 150 and 100 Ton Semi-Auto. Molding Presses, All Slf.-cntd. Dennison 2 Ton Model DD2C61 Multipresses motor and controls (5). Injection Machines: De Mattia, Model B, 24 Oz. Reed-Prentice, 10-E-16, 16 Oz. Machine. Fellows 8 Oz., 1951 Machine, Practically new. Impco, 8 Oz. Vertical Model VF-8, Late Model. Watson-Stillman 6 Oz. Watson-Stillman 4 Oz. Van Dorn 2½ Oz., Brand new in original crate. HPM 2 Oz. NRK 2 Oz. Hand Operated. Van Dorn, Model H-200, 1 Oz. and 2 Oz. Watson-Stillman 202. Tablet Machines: Stokes S-5, 280-G, R-1, T-4, DD-2, DDS-2, RB-2, RD-4, RDS-3, R and T, Colton #5½, #5, #2-RP and #3-RP, KUX 64. Extruders: Royle Nos. 1, 3 and 4; Allen-William 8"-All Individual Motor Drive. 3½" Electrical Heated Extruder. Stokes-Windsor Triple Screw RC-200 Practically new with conveyor and takeup. Hartig Converted 6" Oil Heated. Mills: Farrel 18"x50" (4). Farrel 16"x48" (3), Farrel 16"x40". Available as Mill Lines or as Individual Units. Rotary Cutters: Cumberland No. 0, 2 HP M. D., Ball & Jewell 1 HP M. D., Stainless Steel. Ball & Jewell 1 HP M. D., Plain Steel. Ball & Jewell Heavy Duty Ideal, 5 HP M. D. Calenders: 13"x48" with M. D. 9"x48" Rolls Belt Drive. Mixers: Banbury No. 11, Bodies Only. Banbury No. 9, 200 HP Motor Drive. Banbury No. 3A, 150 HP M. D. Roller Coater: Union Roller Coater, Model B-30-50 New 1952 up to 50" Material. Miscellaneous: Sturtevant Blenders: 1-#12 20,000 lbs. Capacity, Practically New. 2-#10 13,000 lbs. Capacity, never used. Stokes Vacuum Impregnating Equipment. Despatch 3 Drawer and 8 Drawer Preheating ovens. Megatherm 3 KW Preheating Ovens. Vulcanizers, Grinders, Pumps, Valves, Platens, Etc. Johnson Machinery Company, 683P Frelinghuysen Avenue, Newark, N. J. What Have You For Sale? BIgelow 8-2500. What Are You Looking For?

FOR SALE: One HPM—#250-H9 Hydropower Injection Machine with CH-12 HPM Hydro-power dual circuit operating system with (2) 7-R-45X Radial pumps including 20 HP 1200 HPM General purpose sleeve bearing motor. One HPM—#100-H4 Injection Molding Press 4 oz. with one CH-12 HPM Hydro Power Operating System. Both machines are in good operating condition. Reply Box 1112, Modern Plastics.

FOR SALE: (1) Stokes standard 150 ton semi-auto compression press; (1) Wood 30 ton slf.-contd. compression press; (2) Read 285 cu. ft. stainless steel blenders; (8) Cumberland #½ granulators, 5 HP; (1) Hartig 2" elec. extruder; also mixers, mills, cutters, etc. Chemical & Process Machinery Corp., 52 Ninth St., Brooklyn 15, N. Y.

FOR SALE: Injection Presses: 4, 8, 12, 24 oz. Reed, 2, 9, 16 oz. HPM. 32 oz. Vert. HPM. 8, 12 oz. Lester. 4 oz. Lewis. 3 oz. Vert. Munton. 1 & 2 oz. Van Dorn. Extruders: 4½" oilheatd. NRM. 2" steam heatd. NRM Saran Extruder & Pipe set-up. Conveyors. Ovens. Compression & Transfer presses 50 to 600 T., Elmes Hydrolair presses. Pre-form presses: Colton 5½ T & 3. Cutler-Hammer 2KW Electronic Preheaters. Pumps. Vacuum Form. Mach: Abbott Drape 36"x40", Autovac 52"x30". All Midwest Locations. List your Surplus Equipment with me. Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: Markem Printing Machine, hi-prod. semi-auto. dual feed model 25AD-2C Printer. Suitable for imprinting plastics, paper, cloth, flat packages, products or parts. Immed. deliv., seldom used, less than one year old. May be seen in operation. Reply Box 1140, Modern Plastics.

FOR SALE: Triplex Sara Sealer mounted on long support. Equiped with Wheelco Temperature Control Unit. Seals plastic sheeting, foil back and barrier materials. Ideal for fabricating large bags (barrel liners). Manufacturer Sav-Way Sara Seal, Inc., Detroit, Mich. Original cost $1,635.00 now $635.00 f.o.b. Dallas, Texas. Contact Radio City Distributing Company, 720 South Austin Street, Dallas, Texas.

FOR SALE.
Like New—1951 Stokes Preform Press Model #294—Excellent Condition Ready for Immediate Production. For Complete Details. Write
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FOR SALE: (1) ¾ oz. Moslo Minijector Plastic Injection Molding Machine. Hand operated with stand. Machine has had 2 hours service. Complete with die blocks & barrel of plastic. $250. (1) Centrifugal Casting Machine for making dies, $50. Morrissey Displays & Models, 52 Sintsink Drive E., Port Washington, N. Y., PO 7-0414. Above f.o.b. Port Wash.

FOR SALE: 22 ounce Vertical Impco injection molding press. Excellent condition. Can be seen in operation. Principals only. Reply Box 1147, Modern Plastics.

FOR SALE: (2), 350 ton Die Casting Machines, die casting oven for dip painting of die cast and other items, 12 ounce Impco Vertical Molding Machine, (5), 12 ounce Lester Molding Machines, (5), 8 ounce Leominster Tool Molding Machines, (1), 4 ounce Lester Molding Machine. Reply Box 1145, Modern Plastics.

FOR SALE: 2—75 gal. working capacity J. H. Day #5 Cincinnatus Double Sigma Blade Mixer type MDB class 6. Stainless Steel Constructed. Steam jacketed for 40 P.S.I. working pressure. Tilting bowl. Sigma Blades driven by 10 H.P. motor and Reeves vari-drive. Excellent condition. Offered at a greatly reduced price. Best Equipment Company, 617 Davis Street, Evanston, Illinois. DAvis 8-0926.

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1—Girovinyle French Imported cube dicer. In perfect condition. 1—25 H.P. Mitts & Merrill pelletizer. Used for only about 30 hours. In perfect condition.
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STAMP-O-MATIC FOR SALE: We have a stamp-o-matic printing machine, model spc, for sale to best offer received. Will print up to 9 inches, excell. cond. Please write purchasing agent, Loma Plastics, Inc., P.O. Box 11277, Ft. Worth, Texas.

Machinery and equipment wanted

WANTED: 16 oz. H.P.M. injection mach. Must be in running cond. Also one 10 D-8 oz. or 10 D-12 oz. Reed Prentice; not older than 1946. Reply: T. M. West Jr., 1575 Ontario Ave., Pasadena 3, Calif.

MACHINERY WANTED: #3A Banbury with 220 volts 3 phase 60 cycle motor and all necessary controls. Submit price delivery and all pertinent information. Reply Box 1124, Modern Plastics.

WANTED: Approximately 3000 pound capacity jacketed ribbon blender. Bottom center opening, air door preferred. Reply Box 1102, Modern Plastics.

Materials for sale

FOR SALE: Vinyl sheet scrap, white and clear mixed. Apprx. 10,000 lbs. packed in fibre drums for shipping. Quote f.o.b. San Francisco, Calif. Reply Box 1126, Modern Plastics.

FOR SALE.
Have accumulation of Vinyl sheeting compound—Banbury drippings 30 to 50,000 lbs per month. Seeking outlet on a continuous basis.
Reply Box 1138, Modern Plastics.

FOR SALE: 1000 pounds Plexiglass VM 100, Rohm & Haas, sealed drums. Also 2000 pounds unground lucite heels, seconds, as scrap. Reply Box 1105, Modern Plastics.

FOR SALE: We are authorized to sell for a Plastic Button Company (now liquidating) approximately 35,000# of Urea & Phenolic Molding Powders made by Plaskon & Bakelite, various colors & packed in original factory containers. Will sell lot at .09¢ lb., F.O.B. Detroit. Write for list of colors & grades. Globe Trading Co., 1815 Franklin St., Detroit 7, Mich.

Materials wanted

WANTED.
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

WANTED: Plexiglass and Lucite scrap, salvage and cut-offs, any quantity. Turn your surplus sheet stock into cash. Ask for our quotation. Duke Plastics Corp., 584 Broadway, B'klyn 6, N. Y. Evergreen 8-5520.

SCRAP WANTED.
Acetate, Butyrate, Polystyrene, Acrylic, any quantity. Also list your surplus inventory of Virgin molding material with us for sale at highest prices.
Claude P. Bamberger, Inc.
1 Mount Vernon St.
Ridgefield Park, N. J.
Tel: HUbbard 9-5330. Not connected with any other firm of similar name.

(Continued on page 228)

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Modulene has outstanding low temperature flexibility and toughness, superior chemical inertness, freedom from taste, odor and toxicity, excellent dielectric properties, low specific gravity (.92) and low water vapor permeability.

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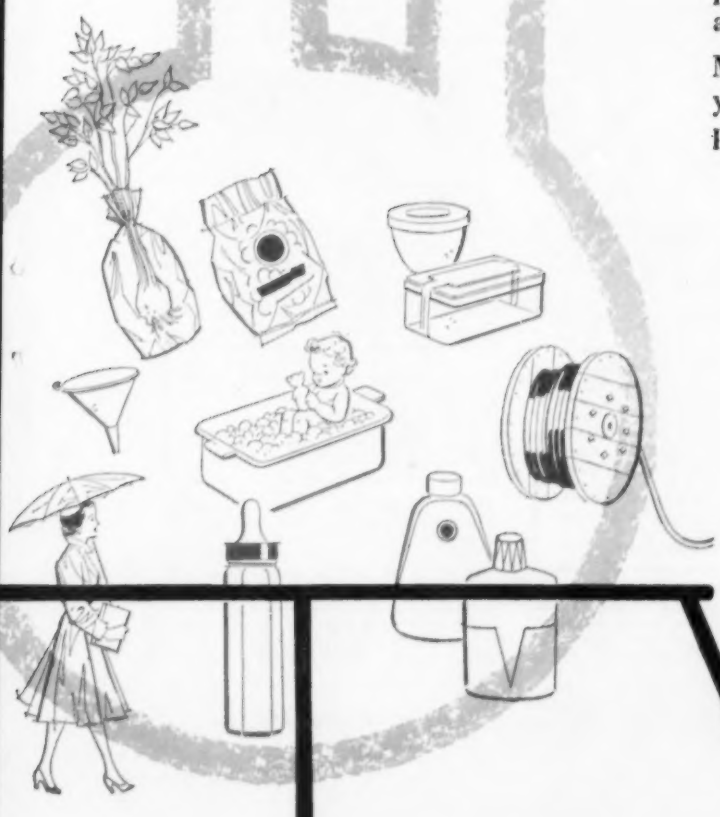

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* *Manufactured by Koppers Company, Inc.*

(*Continued from page 226*)

WANTED: Plastic Scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 601 West 26th Street, New York 1, N. Y.

Molds for sale

FOR SALE: Complete line of Houseware Molds, Comb Molds, also some novelty and specialty items. No reasonable offer refused. Send for list. Reply Box 1135, Modern Plastics.

FOR SALE: A number of Compression Type Plastic Molds, to produce Ashtrays, Cigarette Caskets, Household Articles, Lipstick Cases, Flapjacks and Fancy Goods, etc. All Molds in good condition. A once-in-a-lifetime bargain for an estab. manufacturer, or a rare oppty. for someone entering the manufacturing field. Write for complete information. Reply Box 1139, Modern Plastics.

FOR SALE: New steel injection mold, single cavity, six ounce capacity, for producing clever patented housewares item. Should be of special interest to mail order & gift houses. Royalty basis or full patent rights if desired—Reasonable. Reply Box 1133, Modern Plastics.

FOR SALE: 12 cavity injection mold to make straight sided flat brimmed "Top Hat" height 1"x1-5/16" dia. with 5/16" brim. Overall diameter of brim 2¼". Item suitable as a container when inverted. Adaptable for many novelty purposes. Contact Mr. Meehan, BR 9-9836.

MOLDS FOR SALE: 16" and 20" Plastic "Girl Type" Walking Dolls. Reply Box 1136. Modern Plastics.

Molds wanted

WANTED: 5" Comb Mold—Also Men's 7" Comb Mold. Submit samples and advise number of cavities—price, etc. Reply Box 1128, Modern Plastics.

Help wanted

PLASTIC SALESMAN to call on industrial trade for plastic injection molding concern. Some background in plastic field necessary. Excell. oppty. Salary, comm., and all expenses. State full particulars including experience, age & availability. Reply Box 1119, Modern Plastics.

MAJOR CHEMICAL COMPANY starting Plastics Division needs 2 Regional Sales Manager and 1 Technical Service Manager. Regional Sales Managers for New York and Chicago. Technical Service Manager for Los Angeles. As a new resin producer, we want aggressive, experienced men capable of hiring and training assistants. You will start fresh with a wonderful opportunity for growth in this brand new division. Write us in detail about your experience and references. All inquiries will be treated confidentially and answered promptly. Interviews can be arranged anywhere. Reply Box 1143, Modern Plastics.

PLANT SUPT.—Small—fast growing injection molding plant, upper New York City near Westchester County. Must have thorough knowledge of injection molding, close tolerance and quality products of all materials, including nylon, etc. Must know machine maintenance and finishing operations. Hot stamping etc. $150.00 up. Tremendous opportunity for right man. Reply Box 1137, Modern Plastics.

THERMOPLASTIC DESIGN ENGR.
Southern California writing instrument manufacturer desires detail design engineer familiar with precision injection mold design. Pen and pencil experience desirable, not essential. Write full details on experience, education, age, and salary. All data confidential.
Reply Box 1144, Modern Plastics.

WANTED: For polyethylene extrusion of lay-flat tubing and flat film. Chemical or mechanical engineer for complete supervision of large plant. Must have thorough experience and be able to assume complete responsibility. Assured future for the right man. Located New York City. Salary open. Write fully. Reply Box 1146, Modern Plastics.

PLASTICS EXTRUSION OPERATOR & Ass't Extrusion Foreman: Wanted by progressive New York City firm. Pleasant working conditions, chance for advancement unlimited by "seniority" and other restrictions. Excellent opportunity for right man—applications treated with strictest confidence. Write, giving full details to: President, Box 1117, Modern Plastics.

HELP WANTED.
Plant Manager for moderate sized plant located in Greater New York Area, engaged in compression and injection molding of small parts with proprietary tool shop. This is an excellent position for a man with the proper background as firm is well established. Requirements: Knowledge, ability and interest. Salary excellent. Replies treated confidentially. Reply Box 1149, Modern Plastics.

HELP WANTED: Plastic sheet printer—Lithographer—Laminator for growing San Francisco, California, company. Must be sober, industrious, have references. State qualifications and salary required. Reply Box 1125, Modern Plastics.

PLASTIC CALENDERING: Qualified men experienced in unsupported vinyl for our new calender located Metropolitan New York area as Assistant Engineers—Research Chemists—Color Matchers—Foremen — Banbury — Mill — Calender and Compound Men—Top Wages—Ideal Working Conditions—Permanent Positions with future—Contact Mr. Al Novet, Rudd Plastic Fabrics Corp., 620-62nd Street, Brooklyn, New York, Telephone: GEdney 9-7433.

ESCAMBIA BAY CHEMICAL CORP.
Owned by United Gas Corporation, Electric Bond and Share Company, and National Research Corporation offers opportunities in: Plastics Technical Service—Sales Service. Experienced Graduate Chemists or Chemical Engineers trained in field of vinyls in technical service laboratory and sales service. Northeast location with new expanding chemical company. Liberal benefits such as insurance, hospitalization. Also openings for Technicians trained as above. Send complete resume in confidence to:
W. Mayo Smith, Assistant Director, Escambia Bay Chemical Corporation, 70 Memorial Drive,
Cambridge 42, Massachusetts.

CHEMISTS & CHEM. ENGINEERS: For process engineering and analytical research and development work. Excellent career opportunities in Northern Ohio for qualified technical applicants. Some experience useful, but not essential. Replies confidential. Send resume stating education, experience and salary requirements. Reply Box 1132, Modern Plastics.

ENGINEER: A well known manufacturer of plastic process machinery, presently doing business with some of the larger plastic manufacturers, has a very desirable position available for a graduate engineer with experience in design of vacuum forming machinery. Eastern suburban location. In reply, please furnish complete resume of experience, education and salary desired. Reply Box 1120, Modern Plastics.

MOLD FOREMAN: Requirements: Second shift 3:30-12 p.m., must have knowledge of injection molding, including the handling of molds. Starting salary approximately $90.00 a week, plus bonus. Plastic Inlays, Inc., 282 Broad St., Summit, N. J. See Mr. A. E. Poole. Tel: CRestview 3-5200.

EXTRUSION ENGINEER: Midwest-AAA-1. Experienced in die design, extrusion techniques, production and fabrication of custom profiles in rigid and flexible vinyl, nylon, and polyethylene. Please send resume of experience, education, references and salary requirements in first letter. Reply is held confidential. Reply Box 1134, Modern Plastics.

HELP WANTED.
Molding Room Superintendent: To take charge of Injection Molding Dept. consisting of 9 machines. Applicant must have thorough knowledge of injection molding, tool experience, capable of handling personnel. Plant located in South. Excellent opportunity with a progressive organization. Reply Box 1107, Modern Plastics.

NEW PRODUCTS MANAGER: For the man who is thoroughly acquainted with all sales possibilities of Vinyl Sheetings and fabrics, we offer the chance of a lifetime. For our new calender, we are creating a new position of Products Development. Only the man with drive and initiative can succeed in this new opening. If you are thoroughly convinced that you have the knowledge and creative ability to produce new products for this field, let us know about you. All replies Strictly Confidential—Only applicants submitting complete resume will be considered. Send applications to: Mr. Louis Rudd, Rudd Plastic Fabrics Corporation, 620-62nd Street, Brooklyn 20, New York.

PLANT MANAGER for Plastic Extrusion factory located in Philadelphia, Pa. Must have record of experience and technical know-how along with managerial ability. Opening offers substantial opportunities. State age, health, education, present position and job history. All information kept confidential. Reply to Box 1122, Modern Plastics.

CHEMISTS AND CHEMICAL ENGRS.
For product development in plastics field. Outstanding opportunity to join recently formed Product Development Department of the Atlas Powder Company, located in Wilmington, Delaware. 5-10 years experience in polymers and their application uses required. All responses held confidential. Direct all replies, marked personal to,
R. L. Herrman
Atlas Powder Company
Wilmington, Delaware

TOOLMAKER: For injection molding plant to head up what will eventually be a three or four man shop. Capable of engineering molds, estimating and repair. Salary up to $200.00. Reply Box 1130, Modern Plastics.

FOREMAN: 3rd shift, for small aggressive fast growing injection molding plant. Salary up to $125.00. Reply Box 1131, Modern Plastics.

(*Continued on page 230*)

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Group Leader, Polymerization Chemist, Compounder, permanent positions available in expanding polymer research program of national chemical company. Industrial experience in field of fluorine polymers desirable but not essential. Excellent facilities and pleasant working conditions in Suburban Philadelphia Laboratories. Please send resume of personal data, education, experience, and salary requirements to
Pennsalt Chemicals,
Business Manager, Technical Div.,
P.O. Box 4388, Phila., 18, Pa.
Your correspondence will be held in strict confidence.

INJECTION MOLDING SHOP SUPVR.: Substantial firm, up to 100 oz. equipment. Write stating experience In Detail—technical and educational background and salary desired. Reply Box 1100, Modern Plastics.

PLASTIC ENGINEER: Mech. or Chem. Engr. with Compression & Injection Molding experience, who has the ability to design new molds & molding techniques. Must be capable in doing research & development work. This job requires technical ability & the determination to carry each project through to its completion. Excellent opportunity for a capable man to join a progressive company molding its own products. Midwest location. Write giving full particulars, including salary requirements, in first letter. Reply Box 1116, Modern Plastics.

VINYL CHEMIST.
Manufacturer calendered film and vinyl sheeting requires experienced chemical engineer or chemist. All replies confidential.
Reply Box 1113, Modern Plastics.

MARKET DEVELOPMENT: Excell. oppty. for aggressive man to join Spencer Chemical Company's expanding market development program, which will permit him to utilize his sales and technical ability. We are seeking a man who has a chemical or engineering background, and probably 3-6 years experience. It is desirable that he be familiar with the field of thermoplastics, preferably with thermoplastics molding experience. Please send detailed resume of personal data, experience, education and present salary to: Spencer Chemical Company, 1004 Baltimore, Kansas City, Missouri. Attention: W. H. Swope, Jr. Personnel Mgr.

JOB OPPORTUNITY in plastic development with a successful, progressive, well established Michigan manufacturer—Man with imagination, technical background in plastics, some sales experience, and ability to initiate and complete plastics development projects. Prefer at least five years experience in plastics field. Knowledge of thermoplastic and thermosetting resins, techniques used in molding, extruding, laminating, bonding, casting, calendering, etc. To develop and expand present plastic pipe extrusion operation into further lines. Should have growth potential for advancement to job of higher responsibility. Send complete statement of qualifications. Reply Box 1106, Modern Plastics.

FLOOR TILE CHEMIST.
Experienced manufacture vinyl tile. Location, Midwest. Liberal insurance and pension plan.
Reply Box 1114, Modern Plastics.

WANTED: Semi-experienced and experienced mold designer. Permanent positions for the right men, in the Newark, New Jersey area. Reply stating experience and salary requested to Box 1127, Modern Plastics.

MOLDING SUPERINTENDENT: Wanted for established custom injection molding plant. Must be experienced with most thermoplastic materials and molding equipment. A valuable opportunity to join an exceptionally modern operation now in the midst of rapid growth. All replies treated confidentially. Reply Box 1109, Modern Plastics.

VINYL COLOR MATCHER.
Man expd. in color matching and production color control in film and sheeting.
Reply Box 1115, Modern Plastics.

PLASTICS ENGINEER: Wanted with injection molding background. Must be thoroughly experienced in mold design, materials, and estimating. Your reply will be held confidential. For a really outstanding oppty. with a growing company, Reply Box 1110, Modern Plastics.

PERMANENT POSITIONS now open in California's fastest growing fiberglass firm for experienced Process Engineers, Aircraft Metal Design Engineers, Laminators, Finishers, Press Operators, Leadmen, etc. Write or call Personnel Manager, H. I. Thompson Company, 1611 W. Florence Ave., Inglewood, California.

FOREMEN, VIRGINIA LOCATION: Plastic Extrusion Sheet. Excellent opportunity for expd. extrusion men in our expanding plastic sheet dept. Must be mechanically minded. Attractive pay, liberal benefits, warm climate, friendly community. No housing problem, relocating expenses will be paid. Write letter giving background and past experience to President. Replies kept confidential. Reply Box 1148, Modern Plastics.

MOLD MAKERS: Would you like to live in California and enjoy its climatic advantages? If so, it would be worth your while to investigate the unusual opportunities of working with Revell, Inc., the largest manufacturers of plastic hobby kits in the world. Drop us a note giving us your experience in detail. Revell, Inc., 4223 Glencoe Avenue, Venice, California.

PLASTICS ENGINEER.
Major Los Angeles molder with highly successful, stable, proprietary items seeks competent plastics engineer. Prefer engineering degree and five to ten years injection molding background including difficult tooling assignments. This is a rapidly expanding company that offers wide opportunities for advancement. Please mail full details of your experience and personal history. Reply Box 1103, Modern Plastics.

Situations wanted

PLASTICS SALES or General Manager: For all phases sheet forming from vacuum to plug and ring. Can design, engineer, and price custom manufacture. Can set up equipment and train personnel. Strong on sales. B.S. degree in chemistry, 10 years experience with plastics. References. Reply Box 1129, Modern Plastics.

PRODUCT DEVELOPMENT MGR.: B.S. with background in vinyl film and other thermo plastics. Creative and good idea man in laminating and embossing of films and sheeting. Flair for achieving decorative effects with strong knowledge of textiles. Currently technical coordinator with technical sales and market research responsibilities. Patents granted and pending. Reply Box 1104, Modern Plastics.

Sales agents wanted

REPRESENTATIVE: Progressive, growing Injection Molder with capacity up to 16 oz. including latest high cycle automatic equipment seeks representation in Midwest areas. New modern plant in Chicago area. Reply Box 1118, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE to sell Standard and Custom made vinyl and polyethelene extrusions of tubes and shapes along with standard and custom made molded rubber products. Must have established industrial accounts. Exclusive desirable territories open. Commission basis. Write and include lines currently handling and territory desired. Reply Box 1121, Modern Plastics.

WANTED.
Extruded Plastics Salesmen Wanted by Long Established Manufacturer. Excellent opportunity for salesmen to sell Polyethylene and Vinyl Extrusions. Newly developed extrusions and special facilities meet all industrial needs. Some choice territories still available. In stock service, custom work, fast deliveries. Attractive remuneration arrangement. We are interested only in people who have established contacts for extrusions. Reply Box 1123, Modern Plastics.

Miscellaneous

WELL KNOWN FIRM of the plastics industry issues licences for Modern Production Procedures of Glass Fibre Reinforced Plastics and Expanded Resins (Resin-Foames) among others. Also licences for continuous production of corrugated sheets. Please write to Box 8484, William Wilkens Advertising Agency, Hamburg 1, Germany.

WANTED: Injection molds—one item or complete line of proprietary consumer articles, also interested in molds for industrial parts such as knobs, handles, fasteners, boxes, etc. Will consider purchasing complete injection plant with end products or parts line. Designers: New items wanted—cash or royalty. Victory Mfg. Company, 1722 West Arcade Place, Chicago 12, Ill.—Estab. 1930.

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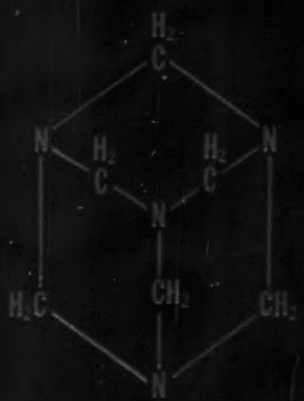

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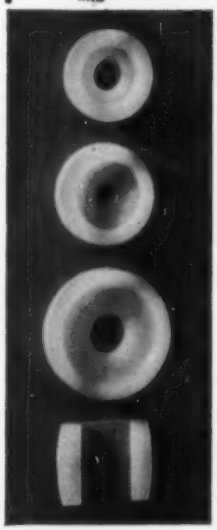

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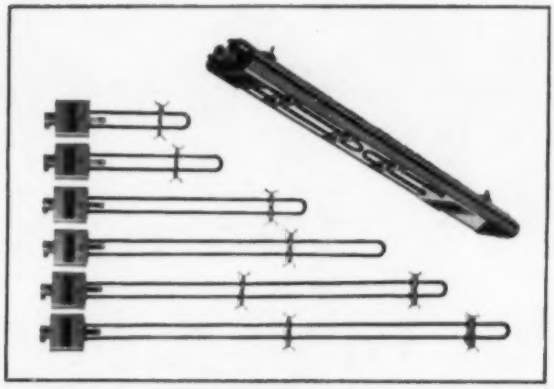

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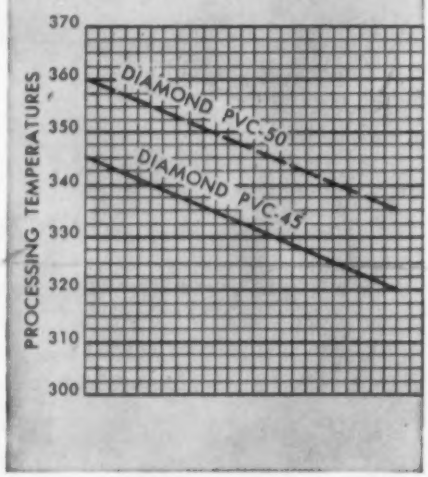

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NSW 6170

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

"Our mold lasted 40% longer when we switched to... G. E.'s 12900 Black general-purpose phenolic molding compound"

That's the report from Kuhn & Jacob Molding & Tool Company, Trenton, N. J., after switching to General Electric's 12900 general-purpose phenolic. Formerly, the mold for these component parts eroded badly at gates and runners. Expensive mold repair—and costly down time—followed. But after switching to *low-erosion* G-E 12900, the mold has lasted *40% longer;* in fact, to date it shows *no appreciable signs of wear.*

This example, from one of the country's leading thermosetting molders, shows how molders benefit from versatile G-E general-purpose phenolics. Specially formulated with low-erosion characteristics to reduce mold wear, these compounds possess excellent moldability and finish—and are among the fastest-curing general-purpose phenolics in the industry.

To get added value, specify and use general-purpose phenolic molding powders manufactured by General Electric!

For more information on G-E phenolic molding compounds, just write to General Electric Company, Section 6C4A1, Chemical Materials Department, Pittsfield, Mass.

Progress Is Our Most Important Product

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